

REGISTER

OF

THE LEHIGH UNIVERSITY,

1896-1897.

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SOUTH BETHLEHEM, PA.

1897.



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THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1896-1897.

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FOUNDED BY ASA PACKER.

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BETHLEHEM, PA.:  
TIMES PUBLISHING COMPANY.  
1897.

TABULAR ALMANAC.

1896.

JULY.

SMTWTFSS

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AUGUST.

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SEPTEMBER.

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1897.

JANUARY.

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1898.

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DECEMBER.

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## CALENDAR.

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1896.

|                   |                             |
|-------------------|-----------------------------|
| Sept. 19, 21, 22, | Examinations for Admission. |
| Sept. 23,         | First Term begins.          |
| Oct. 8,           | Founder's Day.              |
| Nov. 26,          | Thanksgiving Day.           |
| Dec. 23,          | Christmas Holidays begin.   |

1897.

|                               |                                               |
|-------------------------------|-----------------------------------------------|
| Jan. 4, 8 $\frac{1}{4}$ A.M., | Christmas Holidays end.                       |
| Jan. 16,                      | Junior Prize Orations due.                    |
| Jan. 29,                      | First Term ends.                              |
| Feb. 1, 2, 3,                 | Examinations for Admission to<br>Second Term. |
| Feb. 4, 8 $\frac{1}{4}$ A.M., | Second Term begins.                           |
| Feb. 22,                      | Washington's Birthday.                        |
| March 10,                     | Ash Wednesday.                                |
| April 14,                     | Easter Holidays begin.                        |
| April 21,                     | Easter Holidays end.                          |
| May 22,                       | University Day Orations due.                  |
| May 26,                       | Senior Examinations begin.                    |
| June 7,                       | Annual Examinations begin.                    |
| June 9,                       | Graduation Theses due.                        |
| June 13,                      | Baccalaureate Sunday.                         |
| June 14,                      | Class Day.                                    |
| June 15,                      | Alumni Day.                                   |
| June 16,                      | University Day.                               |
| June 17, 18, 19,              | Examinations for Admission.                   |

1897.

1897-1898.

|                   |                             |
|-------------------|-----------------------------|
| Sept. 18, 20, 21, | Examinations for Admission. |
| Sept. 22,         | First Term begins.          |
| Oct. 14,          | Founder's Day.              |
| Dec. 22,          | Christmas Holidays begin.   |

1898.

|                               |                                               |
|-------------------------------|-----------------------------------------------|
| Jan. 3, 8 $\frac{1}{4}$ A.M., | Christmas Holidays end.                       |
| Jan. 31, Feb. 1, 2,           | Examinations for Admission to<br>Second Term. |
| Feb. 3,                       | Second Term begins.                           |
| June 15,                      | University Day.                               |

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St. Luke's Place, South Bethlehem.

WILLIAM L. ESTES, M.D.,  
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St. Luke's Hospital, South Bethlehem.

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HARRY M. ULLMANN, A.B., Ph.D.,  
*Instructor in Quantitative Analysis.*  
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J. HENRY KLINCK, M.E.,  
*Instructor in Electrical Engineering.*  
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HENRY STORRS WEBB, B.S.,  
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JOHN HUTCHESON OGBURN, C.E.,  
*Instructor in Mathematics and Astronomy.*  
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*Instructor in Mechanical Engineering,*  
Sun Inn, Bethlehem.

LEOPOLD OLIVIER DANSE, M.E.,  
*Instructor in Mechanical Engineering,*  
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SCHUYLER S. CLARK, S.B.,  
*Instructor in Physics.*  
505 West Fourth Street, South Bethlehem.

ROBERT B. WILLIAMSON, M.E.,  
*Instructor in Electrical Engineering.*  
505 West Fourth Street, South Bethlehem.

WILLIAM H. HOFFMAN, B.C.E.,  
*Assistant in Civil Engineering.*  
Absent on leave.

NATT M. EMERY, B.A.,

*Assistant in English.*

American House, Bethlehem.

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THE PACKER MEMORIAL CHURCH.

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*Chaplain,*

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*Organist,*

J. FRED WOLLE.

148 Church Street, Bethlehem.

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GYMNASIUM.

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*Instructor,*

C. W. SMITH.

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WILLIAM H. CHANDLER, PH.D.

*Chief Cataloguer,*

A. W. STERNER.

*Cataloguing Clerk,*

WILSON F. STAUFFER.

*Shelf Clerk,*

PETER F. STAUFFER.

## THE LEHIGH UNIVERSITY.

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### ORIGIN.

The HON. ASA PACKER, of Mauch Chunk, during the year 1865, appropriated the sum of \$500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. On this foundation rose THE LEHIGH UNIVERSITY, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of \$1,500,000, and to the University Library one of \$500,000.

### DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, and includes the Classical course, the Latin-Scientific course, and the course in Science and Letters.

### TUITION.

The following charges are made for tuition :

For students in the Technical courses, \$100 per annum: \$60 for the first term, \$40 for the second term; for stu-

dents in the school of General Literature, \$60 per annum: \$40 for the first term, \$20 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a limited number of scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Through the kindness of friends of the University, provision has been made for the awarding of a limited number of free scholarships to students taking the Classical Course who in other respects fulfil the above conditions.

Applications for these free scholarships should be made to the President of the University, who will furnish all needed information concerning the regulations which govern their bestowal.

All fees for tuition are payable to the Treasurer of the University in two instalments, as above. The first instalment is to be paid to the treasurer of the University on or before October 10; the second on or before January 20.

Students who fail to pay tuition fees when due will be notified by the President that their attendance at college exercises must be discontinued until payment is made.

Every candidate for a degree is required to pay a graduation fee of \$10, before the degree is conferred.

### PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning, the attendance being voluntary.

Divine service is held every Sunday morning in the church. Any student who may desire to attend some other place of worship will be permitted to do so upon the request of his parent or guardian or, if he be 21 years of age, upon his own request. The request for such per-

mission should be renewed at the beginning of each term. Attendance, either at the Packer Memorial Church or at the church of his selection, is required of every student.

### SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

South Bethlehem is situated at the junction of the Lehigh Valley, the New Jersey Central, and the Reading (North Pennsylvania) Railroads, and the University buildings are about a half-mile from the station. New York is ninety-two and Philadelphia fifty-eight miles distant.

### BUILDINGS.

#### PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains the lecture and recitation rooms of the departments of Philosophy, Greek, Latin, Modern Languages, English, History, and Mathematics; the lecture, recitation, and drawing rooms, and the collections of the departments of Civil, Mechanical, and Mining Engineering, and the museum of geology and natural history.

#### THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

#### THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparatus," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

#### THE PHYSICAL LABORATORY.

The Physical Laboratory, erected in 1893, is a stone building 235 feet long, mostly 44 feet wide, and four stories in height. The general plan of the floors is to devote each wing to a large room, while the central part provides offices and store rooms, and the extreme ends provide auxiliary rooms and stairways.

FIRST FLOOR.—In the west wing is the dynamo laboratory, comprising dynamo room, battery room, workshop,

calculating room, etc. The dynamo room is 70 feet long and 20 feet wide. A 50 horse-power Straight-line steam-engine drives a line shaft, to which the several dynamos are connected by belting and friction clutches. The electrical plant consists of two Westinghouse rotary transformers, two Edison dynamos, one Thomson-Houston arc dynamo, one Richter arc dynamo, one Wenstrom incandescent dynamo, one Westinghouse alternator, two Tesla induction motors, several small motors, ten alternating current transformers, etc. The laboratory is well equipped with ammeters, voltmeters, wattmeters, and other measuring instruments. In the battery room an 80-cell chloride accumulator supplies current for testing purposes when the engine is not working. In the east wing is the thesis laboratory, consisting of eight small rooms, each of which is furnished with three stone tables resting on foundation piers. One of these rooms is specially fitted up for arc-light photometry.

**SECOND FLOOR.**—In the west wing is the designing room, 56 feet long by 44 feet wide, and adjacent to it is a small room which has been fitted up for blueprinting. In the east wing is the electrical laboratory, 60 feet long by 44 feet wide. It has been furnished and equipped for the several kinds of electrical measurement. A small room adjoining has been fitted up for the measurement of the magnetic qualities of iron. In the central part is the departmental library and reading-room; on the table will be found the current numbers of the principal electrical journals.

**THIRD FLOOR.** The principal apartments are the Lecture Hall in the west wing, and the Lecture Room in the east wing. The former is used for examinations, University lectures, and the meetings of several of the Engineering Societies; the latter is equipped with all the appliances for experimental lectures on physics and electricity.

**FOURTH FLOOR.** The west wing contains two recitation rooms, and the laboratory of general physics; while the east wing contains the light laboratory. The latter, in

addition to desk accommodation for forty students, contains twelve dark rooms fitted up for photometry and photography.

#### THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

#### THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is one of the largest and most magnificent Churches in the State, richly furnished and handsomely appointed in every particular.

#### THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

#### THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

## EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board cannot be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included :

|                                              |          |          |
|----------------------------------------------|----------|----------|
| Tuition, . . . . .                           | \$100    | \$100    |
| Board for 40 weeks, . . . . .                | from 160 | to 200   |
| Room-rent, with fuel and lights . . . . .    | 40 "     | 80       |
| Care of room and use of furniture, . . . . . | 5 "      | 20       |
| Washing and incidentals, . . . . .           | 20 "     | 40       |
| Books, stationery, etc., . . . . .           | 25 "     | 50       |
| Total, . . . . .                             | \$350    | to \$490 |

(In the case of students in the School of General Literature, the charge for Tuition is \$60, and the totals are \$310 to \$450.)

NOTE.—If clubs be formed the cost of board need not exceed \$3.50 per week.

## ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

### DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1897 will be on Monday, Tuesday, and Wednesday, February 1, 2, and 3, for admission to the second term; on Thursday, Friday, and Saturday, June 17, 18, and 19, and on Saturday, Monday, and Tuesday, September 18, 20, and 21, for admission to the first term. No other examinations for admission will be held, except for good cause, and all applicants *must* be in attendance at 8.30 o'clock on the morning of the first day.

The examinations are held in June and September in the following order :

*First Day.*—English, 8.30 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

*Second Day.*—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

*Third Day.*—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be

granted without great inconvenience, and candidates so applying will be required to pay a fee of \$5 into the Faculty's fund for the aid of indigent students.

#### CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age, and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

#### THE CLASSICAL COURSE

are examined in the following subjects:

1. *English*.—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing,—in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books prescribed for admission to the New England colleges. These are, for 1897: Shakespeare's *As You Like It*; Defoe's *Journal of the Plague Year* in London; Irving's *Tales of a Traveller*; Hawthorne's

Twice Told Tales; Longfellow's Evangeline; George Eliot's Silas Marner. The student is also urged to the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

2. *Geography*, general and political.

**In 1898, and thereafter, Geography will not be required of candidates for admission to any course.**

3. *History of the United States*, including the *Constitution*.

[Montgomery's Leading Facts of American History and Fiske's Civil Government may serve to indicate the amount and character of this requirement.]

4. *Algebra*.—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

5. *Geometry*.—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

**In 1898, and thereafter, the whole of "Plane Geometry will be required for admission to the Classical Course.**

6. *Physical Geography*.

7. *Latin Grammar*.

8. *Cæsar*, four books of the Gallic war.

9. *Cicero*, six orations, including the four against Catiline.

10. *Vergil*, the first six books of the *Æneid*, including Prosody.

11. The translation, at sight, of passages from *Cæsar* and *Cicero*.

12. The translation of English into Latin. (As special importance is given this part of the examination, it is

suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

13. *Roman History*.—Creighton, Pennell, or Myers.

14. *Greek Grammar*.

15. *Xenophon*, *Anabasis*, four books.

16. *Homer*, *Iliad*, first three books, including Prosody. The Catalogue of Ships may be omitted.

17. The translation, at sight, of a passage from some work of *Xenophon*.

18. *Greek History*.—Fyffe, Pennell, or Myers.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

Candidates for admission to the Classical Course who have had, in their preparatory schools, no opportunity of studying Greek, will be admitted to that course in full standing upon presenting an amount of French or German equivalent to two years' work. They will begin Greek in the University and study it throughout the course, and will then receive the degree of B.A.

#### THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first thirteen of the above requirements, but substitute for the Greek sections (numbers 14-18 inclusive) the following:

19. *Geometry*.—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's *Geometry*.

#### THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-

Scientific Course, except the Latin and Physical Geography sections (numbers 6-13 inclusive). They also present the following :

20. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; or Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

In 1898, and thereafter, one year's work in German or French will be added to the requirements for admission to the Latin-Scientific Course and to the Course in Science and Letters.

## THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, Chemistry, and Architecture are examined in the following subjects :

1. *English.*—This requirement includes : (a) English Grammar, especial attention being given to the analysis and correction of sentences ; and (b) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing,—in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books prescribed for admission to the New England colleges. These are for 1897 : Shakespeare's *As You Like It* ; Defoe's *Journal of the Plague Year in London* ; Irving's *Tales of a Traveller* ; Hawthorne's *Twice Told Tales* ; Longfellow's *Evangeline* ; George Eliot's *Silas Marner*. The student is also urged to

the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

**In 1898, and thereafter, Geography will not be required of candidates for admission to any course.**

3. *History of the United States*, including the *Constitution*.

[Montgomery's Leading Facts of American History and Fiske's Civil Government may serve to indicate the amount and character of this requirement.]

4. *Algebra*.—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

5. *Geometry*.—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles. Solid Geometry.

6. *Elementary Physics*.

[Avery's Elements of Natural Philosophy (revised edition) is recommended; or Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

**In 1898, and thereafter, one year's work in GERMAN\* will be included in the requirements for admission to the Technical Courses.**

[This requirement in German will be satisfied by the completion of an amount equivalent to Joynes-Meissner's Grammar, Part I, Buchheim's Reader, and additional reading, such as Arnold's *Fritz auf Ferien*.

**Division of Examinations for Admission.**

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years*. In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States. No credit will be given unless the candidate has passed satisfactorily in at least three subjects in one year.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects in one year.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in

\*An equivalent amount in French will be accepted in cases in which it is inconvenient for the candidate to offer German. The amount thus required in French is equivalent to Whitney's Practical Grammar and Super's Reader, with reading of an additional amount equal to Cameron's edition of *Contes de Daudet*.

June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

#### CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

#### SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

#### ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only*.

#### ADMISSION TO GRADUATE COURSES.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

## PREPARATORY SCHOOL CERTIFICATES.

The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department. It has been the custom to accept certificates from schools of high standing in English, Geography, and United States History, but not in Mathematics or Physics. Beginning with the examinations of June, 1897, such certificates will not, as a rule, be accepted so as to dispense with the primary entrance examination in any subject. It is, however, regarded as highly desirable that the examiners should receive from principals of preparatory schools statements with reference to those whom they send up as candidates for entrance, indicating as clearly and fully as possible, in each case, the teacher's opinion of the candidate's character and scholarship and fitness for entering upon collegiate work; and such statements will receive careful consideration, in connection with the results of the entrance examinations.

## PROGRAM OF STUDIES.

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parenthesis immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

## SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no Latin or Greek, but furnishes instead extended instruction in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

A student taking a literary course will be permitted to substitute, at the discretion of the Faculty, studies offered in one or another of the technical courses for a portion of the required work during Junior and Senior years. Such a student will receive the literary degree at the end of the fourth year. If he then desires to pursue the remaining branches in the technical course, he may receive the appropriate degree as soon as this is completed. The amount of additional time thus occupied will be probably from one and a half to two years, depending upon the courses selected and the diligence of the student.

It is believed that the benefit from such a combined course, which unites the advantages of literary training with a professional course, will recommend itself to many persons, and that the maturer condition of the student when he approaches his later work will enable him to make better use of the opportunities then afforded him.

## DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the *Odyssey*, giving attention to epic forms and syntax, to prosody and scanning, and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The *Œconomicus* and *Symposium* of Xenophon and the *Crito* of Plato are read during the term, with sight readings from the *Memorabilia* and the *Apology*; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough re-

view-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus and Thucydides. Selections are made from both authors with the purpose of illustrating their best style and at the same time of presenting, from the original sources, the history of certain interesting epochs; the reading from Herodotus, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author, and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

Students who have presented a modern language for admission instead of Greek will, during Freshman and Sophomore years, cover the ground laid down in the entrance requirements. During Junior and Senior years they will take the Freshman and Sophomore courses, as outlined above.

**LATIN.**—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: *De Senectute* and *De Amicitia* or the *Philippics*, Livy, and the *Odes* and *Epodes* of Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a text-book. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and extensive set of over 3600 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. The *Satires* and *Epistles* of Horace will be read in the first term, and in the second the *Agricola* and *Germania*, with selections from the *Annals* of Tacitus, or *Quintilian*, together with sight reading.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence and Plautus. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's *Remnants of Early Latin*,

supplemented by a series of lectures upon Latin Grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During the first term, Freshman year, Rhetoric is studied, both with the aid of a text-book and through practical exercises, with the design of stimulating invention and imparting the essentials of a clear prose style. In the second term, a brief history of the language is made the nucleus of work.

The Sophomores spend the first term in a careful study of all that is most typical in American literature; the second, in a critical study of the prose of DeQuincey, Macaulay, and Carlyle, following that with a rapid survey of English prose from the XIV to the XIX century.

The Juniors study models of the best Oratory, both English and American, as a preliminary to the writing and delivery of original orations at some time during the first term; and, during the second, specimens from the works of standard Essayists as models for original essays. Careful training is given in the writing and criticism of essays throughout the course. These will be frequent rather than long; on subjects partly literary and in part technical; and the student will be led to maintain a specific thesis with orderly balance of arguments and arrangement of parts.

Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February, and open to students of the Junior class in all courses.

Instruction in elementary Anglo-Saxon is given regularly for one term to the Juniors in the School of General Literature, to be followed in the next term by a more critical

study of the philology and history of the language than would be possible without such an introduction.

Seniors in the same school receive instruction in the early English of Chaucer and his contemporaries, and in the principles and practice of versification. They are required to write a short poem, or a critique of some book, of a purely literary cast, selected for their examination and review. The course is completed by a series of lectures on the English poets from Chaucer to Tennyson, and, later, by lectures on special topics in English Literature too important to be passed over with brief mention, yet too comprehensive to be treated earlier in the course. Topics for 1897 will be taken from the following list: (1) Influence of the Celtic Writings and Traditions of Britain on the Literature of England. (2) The Historical and Literary Value of Anglo-Saxon Literature. (3) The English Bible as an English Classic. (4) The Elizabethan Writers. (5) The Greater Victorian Poets.

Optional courses will be offered as occasion arises. A Reading Club will be formed, and the student will be encouraged to such private and supplementary reading as his time will permit, and to the formation of a small library of standard books.

**MODERN LANGUAGES.**—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German; or both, if time permits.

*French.*—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the Reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of French literature. In addition to this, lectures in French upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

*German.*—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

**MATHEMATICS.**—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, solid geometry, four exercises per week; plane trigonometry begun.

Second term, analytical geometry; plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, higher algebra, three exercises per week.

Opportunity for the study of more advanced mathematics is given in the elective work of the Junior and Senior years.

**ASTRONOMY.**—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

**CHEMISTRY.**—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

**PHYSICS.**—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

**GEOLOGY.**—In the second term of the Senior year, a course of lectures is given in connection with Le Conte's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

**PHYSIOLOGY AND HYGIENE.**—These subjects are taught in a course of lectures during the Freshman year.

**HISTORY AND POLITICAL SCIENCE.**—The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and

Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's *Decline and Fall of the Roman Empire*.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Text-book, Prof. Jevons' "*Lessons in Logic*," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' *Port Royal Logic*, etc.

MENTAL AND MORAL PHILOSOPHY.—The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

*Outlines of Physiological Psychology*.—Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, Wundt's *Grundzüge der Physiologischen Psychologie*, James' *Psychology*, Baldwin's *Handbook*, Ladd's *Elements of Physiological Psychology*, Lotze's "*Medicinische Psychologie*," Ranke's "*Der Mensch*," Sully's *Outlines of Psychology*, Carpenter's *Mental Physiology*, Maudsley's *Physiology and Pathology of the Mind*, Bain's *Mind and Body*, etc., with references to the classical works of Weber, Fechner, and Helmholtz.

*The History of Philosophy*.—Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy,

a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renaissance and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including that of Mr. Spencer.

**ANTHROPOLOGY.**—Senior Class, both terms. These lectures aim at laying the foundation of a scientific study of Man. They include the rudiments of anthropometry and craniology. The earlier lectures give an account of the development, structure, and life of the human body; while the later lectures endeavor to describe the salient peculiarities of existing and prehistoric races of men.

They are based, for the most part, on the works of Bischoff, Broca, Darwin, Hartmann, Haeckel, Huxley, Quételet, Ranke, Virchow, etc.

**CHRISTIAN EVIDENCES.**—Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

**THE COURSE IN SCIENCE AND LETTERS**  
substitutes the following for the Latin and Greek:

**DRAWING.**—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

**ZOOLOGY AND BIOLOGY.**—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by practical biology.

**CHEMISTRY.**—In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

**MINERALOGY.**—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

**GEOLOGY.**—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

## THE CLASSICAL COURSE.

### FRESHMAN CLASS.

#### FIRST TERM.

*Mathematics.*—Solid geometry. (3) Plane trigonometry. (1)

*Chemistry.*—Lectures. Remsen's Inorganic Chemistry. (3)

*Greek.*—Homer: Odyssey. Prosody. (2)

*Latin*.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (2)

*Physiology and Health*.—Lectures. (1)

*English*.—Rhetoric. (2) Lecture. (1) Essays.

#### SECOND TERM.

*Mathematics*.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Greek*.—Xenophon: Economicus. (3)

*Latin*.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

*History*.—History of Greece. (2) History of Rome. (1) Roman antiquities.

*English*.—History of the English Language. (2) Essays.

#### SOPHOMORE CLASS.

##### FIRST TERM.

*Mathematics*.—Algebra. (3)

*Physics*.—Lectures. (3)

*French*.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German*.—Brandt's Grammar. Lode-man's Manual of Exercises. Buchheim's Reader. (2)

*Greek*.—Herodotus. (4)

*Latin*.—Horace: Satires and Epistles. Composition. (3)

*History*.—History of Rome. (1) Antiquities.

*English*.—American literature. (2) Essays.

##### SECOND TERM.

##### REQUIRED.

*French*.—Grammar and reader (continued). (2) Or *German*.—Grammar, exercises, and reader (continued). (2)

*History*.—Weber's Outlines of Universal History. (2)

*Greek*.—Euripides: Medea. (3)

*Latin*.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

*English*.—English prose literature. (2) Essays.

## ELECTIVE.

(At least four hours per week to be selected.)

*Greek*.—Demosthenes: De Corona. (2)

*Latin*.—Plautus. (2)

*French*.—Grammar and reader. (2)

*German*.—Grammar and reader. (2)

*Projection Drawing*.—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

*Drawing and Machine Design*.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

*Chemistry*.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

*Drawing*.—Tracings and blue prints. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. (4)

## JUNIOR CLASS.

## FIRST TERM.

## REQUIRED.

*History*.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

*Philosophy*.—Jevons's Lessons in Logic. (2)

*English*.—English and American Orators. (1)

*French*.—Grammar. George Sand: La Mare au Diable. Theuriet: Bigarreau. (2) Or *German*.—Grammar. Beresford-Webb: German Historical Reading Book. (2)

## ELECTIVE.

(At least eight hours per week to be selected.)

*English*.—Anglo-Saxon. (2)

*Greek*.—Sophocles: Antigone. Antiquities. (3)

*Latin*.—Letters of Cicero and Pliny. (3)

*Mathematics*.—Differential and integral calculus. (4)

*Mechanics*.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics*.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical Laboratory. (1) Electrical Laboratory. (1)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

*Toxicology*.—Lectures. (2)

## SECOND TERM.

### REQUIRED.

*History*.—History of England: Hume. (3)

*Philosophy*.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

*English*.—British Essayists. (1)

*French*.—Prose Composition. Labiche et Martin: *Le Voyage de M. Perrichon*. Short stories by François Coppée and Guy de Maupassant. Dictation. (2) Or *German*.—Buchheim's Prose Composition. Goethe: Hermann und Dorothea. Freytag: *Aus dem Staat Friedrichs des Grossen*. Dictation. (2)

### ELECTIVE.

(At least eight hours to be selected.)

*English*.—Philology of the English tongue. (2)

*Greek*.—Aristophanes: *Clouds*. Æschylus: *Prometheus*. (3)

*Latin*.—Persius, Plautus, and Terence. History of Roman literature. (3)

*Mathematics*.—Differential and integral calculus. Differential equations. (4)

*Mechanics*.—Work of first term continued. (2)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

*Blow-Pipe Analysis*.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

## SENIOR CLASS.

## FIRST TERM.

## REQUIRED.

*History*.—Decline and Fall of the Roman Empire: Gibbon. (3)

*Philosophy*.—Lectures on the history of ancient and mediæval philosophy. (2)

*Astronomy*.—Young's General Astronomy. (3)

*French*.—Sadler's Exercises. Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German*.—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

## ELECTIVE.

(At least six hours to be selected.)

*English*.—Chaucer and his contemporaries. (2)

*Greek*.—Plato: Phædrus. Greek philosophy. (2)

*Latin*.—Lucretius, with lectures. Roman literature. (2)

*Mathematics*.—Hyperbolic trigonometry, theory of errors and least squares. (2)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

*Mechanics of Machinery*.—Hermann-Smith. Graphical Statics of Mechanisms. (2)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

*Quantitative Analysis*.—Fresenius' Quantitative Analysis, and Conference. (6)

## SECOND TERM.

*History*.—History of France. (2)

*Philosophy*.—Lectures on the history of modern philosophy. (2)

*Christian Evidences*.—Lectures. (1)

*French*.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German*.—Readings. Compositions. Lectures in German on modern German authors. (2)

*Geology*.—Lectures. Le Conte. (2)

## ELECTIVE.

(At least six hours to be selected.)

*English*.—Study of Verse. (2)

*Greek*.—Pindar: selected odes. Greek literature. (2)

*Latin*.—Cicero: De Officiis. Lectures on the history of classical philology. (2)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

*Astronomy*.—Practical Astronomy: observatory work. (2)

*Steam Engine*.—Holmes' Steam Engine. (4)

*Quantitative Analysis*.—Fresenius' Quantitative Analysis, and Conference. (6)

*Architecture*.—The history and styles of architecture. (2)

*Hydraulics*.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

*Preparation of Thesis*.

## THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

## FRESHMAN CLASS.

## FIRST TERM.

*Mathematics*.—Solid geometry. (3) Plane trigonometry. (1)

*Chemistry*.—Lectures. Remsen's Inorganic Chemistry. (3)

*German*.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

*Latin*.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (2)

*Physiology and Health*.—Lectures. (1)

*English*.—Rhetoric. (2) Lecture. (1) Essays.

## SECOND TERM.

*Mathematics*.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*German*.—Grammar and Reader (continued). Short stories by different modern authors. (3)

*History*.—History of Greece. (2) History of Rome. (1) Roman antiquities.

*Latin*.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

*English*.—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

## FIRST TERM.

*Mathematics*.—Algebra. (3)

*Physics*.—Lectures. (3)

*French*.—Whitney's Practical French Grammar. Super's Reader. (2)

*German*.—Advanced Grammar. Short stories by different modern authors. (2)

*History*.—History of Rome. (1) Antiquities.

*Latin*.—Horace: Satires and Epistles. Composition. (3)

*English*.—American literature. (2) Essays.

## SECOND TERM.

*French*.—Grammar. Reader (continued). (2)

*German*.—Prose Composition. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

*History*.—Weber's Outlines of Universal History. (2)

*Latin*.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

*English*.—English prose literature. (2) Essays.

*Chemistry*.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

## JUNIOR CLASS.

## FIRST TERM.

*History*.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

*Philosophy*.—Jevons's Lessons in Logic. (2)

*English*.—Anglo-Saxon. (2) English and American Orators. (1)

*French*.—Grammar. George Sand: *La Mare au Diable*. Theuriet: *Bigarreau*. (2)

*German*.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

*Latin*.—Letters of Cicero and Pliny. (3)

#### SECOND TERM.

*History*.—History of England: Hume. (3)

*Philosophy*.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

*English*.—Philology of the English Tongue. (2) British Essayists. (1)

*French*.—Prose Composition. Labiche et Martin: *Le Voyage de M. Perrichon*. Short stories by François Coppée and Guy de Maupassant. Dictation. (2)

*German*.—Readings (continued). Dictation. Compositions. (2)

*Latin*.—Persius, Plautus, and Terence. History of Roman literature. (3)

NOTE.—Calculus may be substituted for Latin throughout the Junior year.

#### SENIOR CLASS.

##### FIRST TERM.

*History*.—Decline and Fall of the Roman Empire: Gibbon. (3)

*Philosophy*.—Lectures on the history of ancient and medieval philosophy. (2)

*Astronomy*.—Young's General Astronomy. (3)

*English*.—Chaucer and his contemporaries. (2)

*French*.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)

*German*.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.

*Latin*.—Lucretius, with lectures. Roman literature. (2)

#### SECOND TERM.

*History*.—History of France. (2)

*Philosophy*.—Lectures on the history of modern philosophy. (2)

*Christian Evidences*.—Lectures. (1)

*Geology*.—Lectures. Le Conte. (3)

*English*.—Study of Verse. (2)

*Latin*.—Cicero: De Officiis. Lectures on the history of classical philology. (2)

*French*.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

*German*.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

NOTE.—Physics may be substituted for Latin throughout the Senior year.

*Preparation of Thesis*.

#### COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

#### FRESHMAN CLASS.

##### FIRST TERM.

*Mathematics*.—Solid geometry. (3) Plane trigonometry. (1)

*Chemistry*.—Lectures. Remsen's Inorganic Chemistry. (3)

*German*.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

*Drawing*.—Elementary projections, shading and lettering. (2)

*Physiology and Health*.—Lectures. (1)

*English*.—Rhetoric. (2) Lectures. (1) Essays.

## SECOND TERM.

*Mathematics*.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Chemistry*.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

*History*.—History of Greece. (2) History of Rome. (1)

*German*.—Grammar and Reader (continued). Short stories by different modern authors. (3)

*English*.—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

### FIRST TERM.

*Mathematics*.—Algebra. (3)

*Physics*.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Laboratory. (2)

*Chemistry*.—Fresenius's Quantitative Analysis. (3)

*French*.—Whitney's Practical French Grammar. Super's Reader. (2)

*German*.—Advanced Grammar. Short stories by different modern authors. (2)

*History*.—History of Rome. (1) Antiquities.

*English*.—American literature. (2) Essays.

### SECOND TERM.

*Physics*.—Heat, magnetism, and light. Lectures. (2) Laboratory. (1)

*Zoölogy*.—Lectures. Orton. (2)

*Steam Engine*.—Holmes's Steam Engine. (4)

*French*.—Grammar. Readings (continued). (2)

*German*.—Prose Composition. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

*History*.—Weber's Outlines of Universal History. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

## FIRST TERM.

*History*.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

*Philosophy*.—Jevons's Lessons in Logic. (2)

*English*.—Anglo-Saxon. (2) English and American Orators. (1)

*French*.—Grammar. George Sand: La Mare au Diable. Theuriet: Bigarreau. (2)

*German*.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

*Zoölogy*.—Lectures on biology. (2)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

## SECOND TERM.

*History*.—History of England: Hume. (3)

*Philosophy*.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

*English*.—Philology of the English Tongue. (2) British Essayists. (1)

*French*.—Prose Composition. Labiche et Martin: Le Voyage de M. Perichon. Short stories by François Coppée and Guy de Maupassant. Dictation. (2)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Compositions. (2)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

## SENIOR CLASS.

## FIRST TERM.

*History*.—Decline and Fall of the Roman Empire. (3)

*Philosophy*.—Lectures on the history of ancient and medieval philosophy. (2)

*Astronomy*.—Young's General Astronomy. (3)

*English*.—Chaucer and his contemporaries. (2)

*French.*—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

*German.*—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

*Geology.* — Williams' Lithology and laboratory practice. (2)

#### SECOND TERM.

*History.*—History of France. (2)

*Philosophy.*—Lectures on the history of modern philosophy. (2)

*Christian Evidences.*—Lectures. (1)

*English.*—Study of Verse. (2)

*French.*—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

*German.*—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

*Geology.* — Historic and dynamic geology. LeConté. (3)

*Preparation of Thesis.*

## THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

- I. The Course in Civil Engineering.
- II. The Course in Mechanical Engineering.
- III. The Course in Mining Engineering.
- IV. The Shorter Course in Mining.
- V. The Course in Electrical Engineering.
- VI. The Course in Chemistry.
- VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year; except that students who propose to take the course in Mechanical Engineering or that in Analytical Chemistry are required to take German. Students taking any of the other technical courses are strongly advised to elect German, but are not required to do so. After the first term the student follows the program of the course which he has selected.

### FRESHMAN CLASS.

#### FIRST TERM.

*Mathematics.*—Algebra. (3) Plane trigonometry. (1)

*Chemistry.*—Lectures. Remsen's Inorganic Chemistry. (3)

*German.*—Joynes - Meissner's Grammar. Buchheim's Reader. (3) Or *French.*—Whitney's Practical French Grammar. Super's Reader. (3)

*Drawing.*—Free-hand sketching and lettering. (2)

*English.*—Rhetoric. (2) Lecture. (1) Essays.

*Physiology and Health.*—Lectures. (1)

### THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice. Tests and experiments on materials are made in the testing laboratory.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings, and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge is finally determined and compared with the dead load

assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting-office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering begins with the study of systems of water supply, the collection, purification, and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage of houses. This is followed by the theory of the flow of water in pipes and channels, together with the subject of hydraulic motors.

Beginning with the summer of 1898, students taking the Course in Civil Engineering will be required to take a part of the Surveying included in that course at the Summer School (see page 98). The time heretofore given to this subject will thus be made available for instruction in other subjects, and the course thereby extended and enriched.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.).

#### FRESHMAN CLASS.

##### FIRST TERM.

*See page 50.*

##### SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Construction.*—Materials, masonry, and carpentry. Roads, streets, and pavements. Sketches of structures. (2)

*Projection Drawing.*—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

*German*.—Grammar and reader (continued). Short stories by different modern authors. (3) Or *French*.—Grammar and reader (continued). (3)

*English*.—History of the English language. (2) Essays.

#### SOPHOMORE CLASS.

##### FIRST TERM.

*Mathematics*.—Differential and integral calculus. (3)

*Mechanics*.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics*.—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*Architectural Drawing*.—Plans of piers and arches. Problems in stone cutting. Use of water colors. (3)

*German*.—Advanced Grammar. Short stories by different modern authors. (2) Or *French*.—Grammar. George Sand: *La Mare au Diable*. Dumas: *Pauline*. (2)

*English*.—American literature. (2) Essays.

##### SECOND TERM.

*Mathematics*.—Differential and integral calculus. Differential equations. (4)

*Mechanics*.—Work of first term continued. (2)

*Land Surveying*.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (4)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*German*.—Advanced Grammar. Beresford-Webb: *German Historical Reading Book*. Freytag: *Aus dem Staat Friedrichs des Grossen*. Dictation. (2) Or *French*.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: *Le Cachet Rouge*. Dictation. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

## FIRST TERM.

*Mathematics*.—Hyperbolic trigonometry, theory of errors and least squares. (2)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

*Construction*.—Foundations, arches, walls, dams, and bridges. Visits of inspection. (3)

*Topographic Surveying*.—Field work with transit and stadia, and with plane table. Topographic maps. (3)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Or *French*.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

*English*.—English and American Orators. (1)

## SECOND TERM.

*Railroad Surveying*.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

*Roofs and Bridges*.—Theory and calculations of stresses in roof and bridge trusses. (5)

*Sanitary Engineering*.—Collection, purification and distribution of water. Systems of water supply and sewerage. Disposal of sewage. House drainage. Irrigation engineering. (2)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

*German or French*.—Readings. Compositions. Lectures on German or French literature. (1) Technical readings. (1)

*English*.—British Essayists. (1)

## SENIOR CLASS.

## FIRST TERM.

*Astronomy.*—Descriptive Astronomy. (3)

*Bridges.*—Graphic statics. Design of plate girders, riveted bridges, and pin-connected trusses, with working drawings. (7)

*Geodetic Surveying.*—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (2)

*Mechanics of Machinery.*—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

*Geology.*—Williams' Lithology, with practical exercises in determining rocks. (2)

## SECOND TERM.

*Astronomy.*—Practical Astronomy; observatory work. (2)

*Bridges.*—Theory of cantilever, draw, continuous, suspension, and arched structures. (3)

*Hydraulics.*—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. (3)

*Electricity.*—Equipment and operation of electric railways. Measurement of power. (2)

*Geology.*—Historic and dynamic. Le Conte. (3)

*Christian Evidences.*—Lectures. (1)

*Preparation of Thesis.* (3)

## THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their

work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not under construction in the shops at the time and the

drawings for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design

of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the students in the form of rough sketches, photographs, or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

Beginning with the summer of 1898, a part of the work included under the head of Shop Visits will be given at a Summer School, beginning immediately after the close of the Second Term and extending over three or four weeks. Attendance at the Summer School will be required. The time heretofore occupied by this work will thus be made available for instruction in other subjects, and the course thereby extended and enriched.

All the students in this course are required to study German.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

#### FRESHMAN CLASS.

##### FIRST TERM.

*See page 50.*

##### SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Drawing and Machine Design.*—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

*Visits of Inspection.*—Examination and sketching of principal machine parts in the shops of the vicinity. (1)

*German.*—Grammar and reader (continued). Short stories by different modern authors. (3)

*English.*—History of the English language. (2) Essays.

### SOPHOMORE CLASS.

#### FIRST TERM.

*Mathematics.*—Differential and integral calculus. (3)

*Mechanics.*—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics.*—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*Machine Design.*—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

*Visits of Inspection.*—Examination and sketching of principal machine parts in the shops of the vicinity. (1)

*German.*—Advanced Grammar. Short stories by different modern authors. (2)

*English.*—American literature. (2) Essays.

#### SECOND TERM.

*Mathematics.*—Differential and integral calculus. Differential equations. (4)

*Mechanics.*—Work of first term continued. (2)

*Physics.*—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*Steam Engine.*—Holmes' Steam Engine. (4)

*German.*—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

*English.*—English prose literature. (2) Essays.

#### JUNIOR CLASS.

##### FIRST TERM.

*Mathematics.*—Projective geometry. (2)

*Strength of Materials.*—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

*Mechanics of Machinery.*—Hermann-Smith. Graphical Statics of Mechanisms. (2)

*Mechanical Technology.*—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (5)

*Boilers.*—Wilson. Strength, construction, and wear and tear of boilers. (1)

*German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

*English.*—English and American Orators. (1)

##### SECOND TERM.

*Kinematics of Machinery.*—Nature and equivalence of mechanisms. Diagrams of the changes of position, speed, and acceleration in mechanisms. Valve and link motions. (6)

*Machine Design.*—Calculations and working drawings for a high-speed steam engine. (5)

*Machinery of Transmission.*—Weisbach-Herrmann. (3)

*German.*—Readings. Compositions. Lectures on German literature. (1) Technical readings. (1)

*English.*—British Essayists. (1)

#### SENIOR CLASS.

##### FIRST TERM.

*Thermodynamics.*—General principles; application to steam engines and air compressors. (3)

*Graphical Statics.*—Graphical analysis of roof trusses and girders. (2)

*Machine Design.*—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (3)

*Metallurgy.*—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

*Measurement of Power.*—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

*Mechanics of Machinery.*—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. (2)

#### SECOND TERM.

*Mechanics of Machinery.*—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

*Machine Design.*—Original designs. (5)

*Hydraulics.*—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

*Measurement of Power.*—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

*Christian Evidences.*—Lectures. (1)

*Preparation of Thesis.*

#### THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course simi-

lar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

MODERN LANGUAGES.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

DRAWING AND CONSTRUCTION.—The course in mechanical drawing begins with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches, exercises in projection drawing from the same, and the proportioning of simple tools and machines.

A brief course in descriptive geometry is given, in which the student is grounded in the fundamental principles of the subject. The simpler applications are given in the form of problems, and a number of practical examples are worked out in the drawing room.

Under the charge of an instructor, the students make visits of inspection to mines and metallurgical works, during which they examine and make sketches of portions of the plant, and take notes concerning it. From these sketches and notes they subsequently make working drawings accompanied by written memoirs explanatory of the construction and operation of the plant.

In a later portion of the course, the students are required to make original designs for mining and metallurgical plant under given conditions, involving exercise in the adaptation and proportioning of structures, machinery, and apparatus to suit the conditions given.

The field work in mining and geological surveying is followed by map construction from field notes.

**CHEMISTRY.**—The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed \$120.

**MINERALOGY.**—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and

microscopic mineralogy to a few students who may receive permission to pursue such a course.

**GEOLOGY.**—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2500 specimens in the collections, embracing nearly all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra-morainic" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

**ASTRONOMY.**—After studying the theory of the subject two-thirds of the year are devoted to practical work in the observatory.

**APPLIED MECHANICS.**—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

**SURVEYING.**—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

Beginning with the summer of 1898, students taking either of the Courses in Mining Engineering will be required to take a part of the surveying included in those

courses at the Summer School (see page 97). The time heretofore given to this subject will be made available for instruction in other subjects, and the course hereby extended and enriched.

**METALLURGY.**—There are two courses, making, together, about one hundred and forty lectures on this subject, which extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure the student's understanding the fundamental principles of metallurgy, and his becoming so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

**MINING.**—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene

and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for manufacture of spelter and oxide of zinc may be studied at the works of the Lehigh Zinc and Iron Co. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

### THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

## FRESHMAN CLASS.

## FIRST TERM.

*See page 50.*

## SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Chemistry.*—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

*Stoichiometry.* (2)

*German.*—Grammar and reader (continued). Short stories by different modern authors. (3) Or *French.*—Grammar and reader (continued). (3)

*English.*—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

## FIRST TERM.

*Mathematics.* — Differential and integral calculus. (3)

*Mechanics.*—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics.*—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*Drawing.*—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., accompanying the study of descriptive geometry and illustrated from examples of mining and metallurgical plant. (4)

*German.*—Advanced Grammar. Short stories by different modern authors. (2) Or *French.*—Advanced Grammar. George Sand: *La Mare au Diable*. Dumas: *Pauline*. (2)

*English.*—American literature. (2) Essays.

## SECOND TERM.

*Mathematics.*—Differential and integral calculus. Differential equations. (4)

*Mechanics*.—Work of first term continued. (2)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*Drawing*.—Flat tinting with water colors. Graphical problems illustrating the direction and extent of throw in faults. Examination and sketching of metallurgical plant in the vicinity. General views and working drawings of the plant examined, accompanied by written descriptions of its construction and operation. (4)

*German*.—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2) Or *French*.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: Le Cachet Rouge. Dictation. (2)

*English*.—English prose literature. (2) Essays.

#### JUNIOR CLASS.

##### FIRST TERM.

*Mathematics*.—Hyperbolic trigonometry, theory of errors and least squares. (2)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

*Chemistry*.—Fresenius' Quantitative Analysis. (3) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).

*Chemical Philosophy*.—Tilden. Chemical calculations. Whiteley. (3)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Or *French*.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

*English*.—English and American Orators. (1)

## SECOND TERM.

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

*Blow-Pipe Analysis*.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

*Chemistry*.—Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

7. Lead ore (Pb, S).
8. Ilmenite (TiO<sub>2</sub>).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H<sub>2</sub>O, S, P).

*Steam Engine*.—Holmes' Steam Engine. (4)

*Land Surveying*.—Theory and use of level and transit. Field practice and map drawing. (2)

*German or French*.—Readings. Compositions. Lectures on German or French literature. (1) Technical readings. (1)

*English*.—British Essayists. (1)

## SENIOR CLASS.

### FIRST TERM.

*Metallurgy*.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

*Blow-Pipe Analysis*.—Practice. (1)

*Lithology*.—Williams' Lithology, with practical exercises in determining rocks. (3)

*Mechanics of Machinery*.—Herrmann-Smith. The graphical statics of mechanisms. (2)

*Assaying.*—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

*Chemistry.*—Quantitative analysis: laboratory work: Fresenius. (2) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

*Measurement of Power.*—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

#### SECOND TERM.

*Mining.*—Mechanical preparation of ores. Coal washing. Lectures. (2)

*Metallurgy.*—Of copper, lead, silver, gold, &c. (4)

*Drawing.*—Designing of furnaces and other metallurgical plant. (2)

*Mechanics of Machinery.*—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

*Hydraulics.*—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

*Christian Evidences.*—Lectures. (1)

*Preparation of Thesis.*

*Gymnasium.*

#### GRADUATE YEAR.

##### FIRST TERM.

*Mining.*—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

*Geology.*—General geological definitions and principles. Dynamic geology. Dana. (2)

*Drawing*.—General views of mining plant and detailed sketches. (3)

*Astronomy*.—Descriptive Astronomy. (3)

*Topographic Surveying*.—Field work, with transit and stadia, and with plane table. Topographical maps. (3)

*Mine Surveying*.—Theory and problems. (1)

#### SECOND TERM.

*Geology*.—Historic geology. Dana. (2)

*Projects*.—In geology and mining. Designing of mining plant. (3)

*Mining*.—Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. (3)

*Mine Surveying*.—Practice, with construction of mine maps. (1)

*Geological Surveying*.—Theory, practice, and map-drawing. (1)

*Railroad Surveying*.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

*Astronomy*.—Practical Astronomy; observatory work. (2)

*Preparation of Thesis*.

#### THE COURSE IN MINING.

This course is so designed that the student who desires to pursue the practice of mining and ore-dressing, may be prepared for practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

For such students as may take the surveying of second term sophomore year in the summer school at the end of freshman year, or that of first term junior year at the end of sophomore year, or both, advanced work will be provided in such subjects as may be agreed upon by the student and the professor in charge of the department; and all graduates from this course can obtain the degree of E.M., by one year of post-graduate work.

## FRESHMAN CLASS.

## FIRST TERM.

*See page 50.*

## SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Chemistry.*—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

*Drawing.*—Tracings and blue prints. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. (4)

*German.*—Grammar and reader (continued). Short stories by different modern authors. (3) Or *French.*—Grammar and reader (continued). (3)

*English.*—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

## FIRST TERM.

*Mathematics.*—Differential and integral calculus. (3)

*Mechanics.*—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Drawing.*—Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Graphical problems illustrating the direction and extent of throw in faults. (2)

*Physics.*—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*Crystallography.*—Lectures, with practical exercises in the determination of crystals. (2)

*German.*—Advanced Grammar. Short stories by different modern authors. (2) Or *French.*—Grammar. George Sand: *La Mare au Diable*. Dumas: *Pauline*. (2)

*English.*—American literature. (2) Essays.

## SECOND TERM.

*Mathematics*.—Differential and integral calculus. Differential equations. (4)

*Mechanics*.—Work of first term continued. (2)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

*Land Surveying*.—Theory and use of level and transit. Field practice and map-drawing. (2)

*Blow-Pipe Analysis*.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

*German*.—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2) Or *French*.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: Le Cachet Rouge. Dictation. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

## FIRST TERM.

*Drawing*.—Mining construction. (2)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

*Geology*.—General geological definitions and principles. Dynamic geology. Dana. (2)

*Lithology*.—Williams' Lithology, with practical exercises in determining rocks. (3)

*Topographic Surveying*.—Field work with transit and stadia, and with plane table. Topographical maps. (4)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Or *French*.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

*English*.—English and American orators. (1)

## SECOND TERM.

*Geology*.—Historic geology. Lectures. Dana. (2)

*Mining*.—Prospecting. Economic geology. Boring. Valuation of property. Timbering and walling. Support of excavations. Tunneling. Systems of mining. Lectures. (3)

*Steam Engine*.—Holmes' Steam Engine. (4)

*Railroad Surveying*.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*German or French*.—Readings. Compositions. Lectures on German or French literature. (1) Technical readings. (1)

*English*.—British Essayists. (1)

## SENIOR CLASS.

## FIRST TERM.

*Mining*.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

*Drawing*.—Mining design. (3)

*Geodetic Surveying*.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (2)

*Assaying*.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

*Mechanics of Machinery*.—Herrman-Smith. The graphical statics of mechanisms. (2)

*Mine Surveying*.—Theory, with problems in tunneling, shaft location, and survey of bore-holes. (1)

*Measurement of Power*.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

## SECOND TERM.

*Mining*.—Mechanical preparation of ores. Coal washing. (2)

*Projects*.—In mining. Designing of mining plant. (3)

*Mechanics of Machinery.*—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

*Mine Surveying.*—Practice, with construction of mine maps. (1)

*Geological Surveying.*—Theory, practice, and map construction. (1)

*Hydraulics.*—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

*Measurement of Power.*—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

*Christian Evidences.*—Lectures. (1)

*Preparation of Thesis.*

*Gymnasium.*

## THE COURSE IN ELECTRICAL ENGINEERING.

The special technical studies of the course may be grouped under the following heads: Physics Laboratory, Principles of Electricity and Magnetism, Electrical Laboratory, Alternating Currents, Dynamo-Electric Machinery, Dynamo Laboratory, Dynamo Design, and the Applications of Electricity.

The work in the Physics Laboratory extends throughout the Sophomore year, and consists of quantitative experiments in mechanics, heat, light, and sound.

The principles of Electricity and Magnetism are studied by means of an experimental course in the Sophomore year, followed in the Junior year by a course on their practical application and a study of the system of electrical units, symbols, and abbreviations.

The work in the Laboratory of Electrical Measurement extends throughout the Junior year, and may be classified as follows: measurement of ordinary resistances, of low resistances, of insulation resistances; determination of the capacity of condensers, of the electromotive force and

resistance of batteries, of the coefficient of self-induction of a circuit: determination of the horizontal component of the earth's magnetism, the specific resistance and temperature coefficients of wires, and the magnetic qualities of iron and steel. To this is added the design and construction of some piece of electrical apparatus.

The principles of Alternating Currents are studied during the second term of the Junior year, after the student has acquired a knowledge of differential equations, and before he takes up the study of alternating current machinery. The subject is studied both analytically and graphically.

The study of Dynamo-Electric Machinery extends throughout the three last terms of the course, and falls into the three natural divisions of direct-current generators and motors, alternating-current generators, motors, and transformers, and polyphase machinery.

The work in the Dynamo Laboratory extends throughout the Senior year, and consists of a full course in the handling and testing of dynamos, motors, transformers, storage batteries, circuits, instruments, etc.

The work in the Designing Room extends throughout the Senior year, and consists of the design of several types of machine, and the complete design in all its details of a multipolar generator.

The Applications of Electricity are studied throughout the last three terms of the course: telephony and telegraphy in the second term of the Junior year, electric lighting in the first term and electric power in the second term of the Senior year. In each case the instruction in the classroom is supplemented by visits to stations and factories. These visits are considered part of the class work, and each member of the class is required to hand in a report.

The technical studies pursued in other departments of the University are as follows: in the department of Mechanical Engineering, Machine Design, Steam Engine, Boilers, Graphical Statics of Mechanisms, Thermodynamics, and the Measurement of Power; in the department

of Civil Engineering, Freehand Drawing, Strength of Materials, Surveying, and Hydraulics; in the department of Mineralogy and Metallurgy, Electrometallurgy.

Beginning with the summer of 1898, students taking the Course in Electrical Engineering will be required to take the work in Surveying included in that course at the Summer School (see page 97). The time heretofore given to that subject will thus be made available for instruction in other subjects, and the course hereby extended and enriched.

A deposit of \$10 for the year is required from each student before he is allowed to work in any of the laboratories. From this deposit, at the end of the year, is deducted the cost of any materials wasted or apparatus injured by him during the year.

The student who completes all the studies of this course will receive the degree of Electrical Engineer (E. E.).

For the benefit of graduates in Electrical Engineering who desire to study the advanced portions of electrical science, instruction is offered in the mathematical theory of electricity and magnetism, space analysis, and mathematical physics in general.

#### FRESHMAN CLASS.

##### FIRST TERM.

*See page 50.*

##### SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Chemistry.*—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

*Drawing and Machine Design.*—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (3)

*German*.—Grammar and reader (continued). Short stories by different modern authors. (3) Or *French*.—Grammar and reader (continued). (3)

*English*.—History of the English language. (2) Essays.

#### SOPHOMORE CLASS.

##### FIRST TERM.

*Mathematics*.—Differential and integral calculus. (3)

*Mechanics*.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics*.—Mechanics, heat, and light. Lectures. (2) Physical laboratory. (2)

*Machine Design*.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

*Electricity and Magnetism*.—An experimental course in the principles of the science. (2)

*German*.—Advanced Grammar. Short stories by different modern authors. (2) Or *French*.—Grammar. George Sand : *La Mare au Diable*. Dumas : *Pauline*. (2)

*English*.—American literature. (2) Essays.

##### SECOND TERM.

*Mathematics*.—Differential and integral calculus. Differential equations. (4)

*Mechanics*.—Work of first term continued. (2)

*Steam Engine*.—Holmes' *Steam Engine*. (4)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Physical laboratory. (1)

*German*.—Advanced Grammar. Beresford-Webb : *German Historical Reading Book*. Freytag : *Aus dem Staat Friedrichs des Grossen*. Dictation. (2) Or *French*.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny : *Le Cachet Rouge*. Dictation. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

## FIRST TERM.

*Mathematics*.—Hyperbolic trigonometry, theory of errors and least squares. (2)

*Electricity*.—Advanced course in the principles of electricity and magnetism. (3)

*Units*.—Lectures and exercises on the system of electric and magnetic units. (1)

*Electrical Laboratory*.—Course in electrical measurements. Text-book: Holman's Electrical Measurements. Books of reference: Nichols's Junior Course, Fleming's Notes and Forms, Stewart & Gee's Practical Physics, Ewing's Magnetism of Iron, Macfarlane's Mathematical Tables. (3)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

*Boilers*.—Wilson. Strength, construction, and wear and tear of boilers. (1)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Or *French*.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

*English*.—English and American Orators. (1)

## SECOND TERM.

*Dynamo-electric Machinery*.—Direct-current generators and motors. Text-book: Thompson's Dynamo-electric Machinery. (3)

*Alternating Currents*.—The analytical and graphical treatment of alternating currents. (3)

*Electrical Laboratory*.—Continuation of course in electrical measurements. (3)

*Telegraphs and Telephones*.—Lectures. (3)

*Surveying*.—Theory and use of instruments. Land surveying and leveling. Location of electric railways. (2)

*German or French.*—Readings. Compositions. Lectures on German or French literature. (1) Technical readings. (1)

*English.*—British Essayists. (1)

#### SENIOR CLASS.

##### FIRST TERM.

*Dynamo-electric Machinery.*—Alternators and transformers. (2)

*Dynamo Design.*—Lectures. (1) Draughting. (2)

*Electric Lighting.*—Lectures. (2)

*Dynamo Laboratory.* (3) Text-book recommended: Nichols's Senior Course.

*Measurement of Power.*—Indicating of steam engines and dynamometer experiments. (1)

*Mechanics of Machinery.*—Herrmann-Smith. The graphical statics of mechanisms. (2)

*Thermodynamics.* (3)

*Station Visits.*

##### SECOND TERM.

*Dynamo-electric Machinery.*—Polyphase apparatus. (2)

*Dynamo Design.*—Lectures. (1) Draughting. (2)

*Dynamo Laboratory.* (3)

*Electro-metallurgy.*—Lectures. (1)

*Electric Power.*—Lectures. (2)

*Station Visits.*

*Hydraulics.*—Flow of water through orifices, pipes, and channels. Hydraulic motors. (3)

*Christian Evidences.* (1)

*Preparation of Thesis.*

#### THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories,

mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted to the preparation of teachers of chemistry and as a course preliminary to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

**THEORETICAL CHEMISTRY.**—Instruction in this subject begins with lectures three times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy, Whiteley's Chemical Calculations, and Remsen's Chemistry; in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

**ANALYTICAL CHEMISTRY.**—Qualitative analysis is taught in the second term of the Freshman year, by lectures,

recitations, and practical work in the qualitative laboratory, fifteen hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped like the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Fifteen hours per week of laboratory work are required.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

**GAS ANALYSIS** is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

**ASSAYING.**—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year,

nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

**ORGANIC CHEMISTRY.**—The practical work in this subject is performed in the second term of the Junior year, eighteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities; chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of fifty pure organic compounds and a number of analyses are included.

**INDUSTRIAL CHEMISTRY.**—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer

and apparatus for determining the sulphur, ammonia, and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, tallow, illuminating and lubricating oils, rubber, explosives, paints, asphalts, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City. Fifteen hours of laboratory work are required each week throughout the Senior year.

**TOXICOLOGY.**—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

**SANITARY CHEMISTRY.**—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, baking-powders, flour, bread, tea, coffee, cocoa, spices, milk, butter, lard, beer, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

**PHOTOGRAPHIC CHEMISTRY.**—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

**PHYSIOLOGICAL CHEMISTRY.**—The examination of urine, blood, organic and inorganic poisons, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

**MICROSCOPY.**—Instruction in the use of the microscope is given in the first term of the Senior year, six hours of laboratory work each week being required.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted to special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed \$50 per year.

#### FRESHMAN CLASS.

##### FIRST TERM.

*See page 50.*

##### SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Chemistry.*—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

*Stoichiometry.* (2)

*German.*—Grammar and Reader (continued). Short stories by different modern authors. (3)

*English.*—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

## FIRST TERM.

*Chemical Philosophy.*—Tilden. Chemical calculations. Whiteley. (3)

*Quantitative Analysis.*—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate ( $\text{Cr}_2\text{O}_3$ ).
3. Barium chloride ( $\text{Ba}$ ,  $\text{Cl}$ ,  $\text{H}_2\text{O}$ ).
4. Magnesium sulphate ( $\text{MgO}$ ,  $\text{SO}_3$ ,  $\text{H}_2\text{O}$ ).
5. Disodium hydrogen phosphate ( $\text{P}_2\text{O}_5$ ).
6. Rochelle salt ( $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ).
7. Volumetric determination of chlorine.
8. Acidimetry ( $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ ,  $\text{HC}_2\text{H}_3\text{O}_2$ ).
9. Alkalimetry ( $\text{KOH}$ ,  $\text{NaOH}$ ,  $\text{NH}_4\text{OH}$ , soda ash, pearl ash).

10. Chlorimetry (bleaching powders).

*Quantitative Analysis.*—Conference. (1)

*Physics.*—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*German.*—Advanced Grammar. Short stories by different modern authors. (2)

*English.*—American literature. (2) Essays.

## SECOND TERM.

*Physics.*—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*Quantitative Analysis.*—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore ( $\text{Cu}$ ).
12. Zinc ore ( $\text{Zn}$ ). By both gravimetric and volumetric methods.
13. Lead ore ( $\text{Pb}$ ,  $\text{S}$ ).
14. Silver coin ( $\text{Au}$ ,  $\text{Pb}$ ,  $\text{Ag}$ ,  $\text{Cu}$ ).
15. Spiegeleisen ( $\text{Mn}$ ).
16. Copper alloys (complete analysis).
17. Ilmenite ( $\text{TiO}_2$ ).

18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash,  $H_2O$ , S, P).
21. Slag (complete analysis).

*Quantitative Analysis*.—Conference. (1)

*Chemistry*.—Remsen. Advanced course. (3)

*German*.—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

### FIRST TERM.

*Toxicology*.—Lectures. (2)

*Quantitative Analysis*.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student :

22. Guano ( $NH_3$ ,  $P_2O_5$ ,  $H_2O$ ).
23. Clay (complete analysis).
24. Manganese ore ( $MnO_2$ ).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

*Quantitative Analysis*.—Conference. (1)

*Organic Chemistry*.—Lectures and recitations. (4)

*Crystallography*.—Lectures, with practical exercises in the determination of crystals. (2)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

*English*.—English and American Orators. (1)

### SECOND TERM.

*Organic Chemistry*.—Laboratory. (6)

*Organic Chemistry*.—Conference. (1)

*Metallurgy*.—Of copper, lead, silver, gold, etc. (5)

*Mineralogy*.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

*Blow-Pipe Analysis*.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

*German*.—Readings. Compositions. Lectures on German literature. (1) Technical readings. (1)

*English*.—British Essayists. (1)

#### SENIOR CLASS.

##### FIRST TERM.

*Metallurgy*.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

*Assaying*.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

*Industrial Chemistry*.—Laboratory. (3)

*Geology*.—Williams' Lithology, with practical exercises in determining rocks. (3)

*Microscopy*.—Laboratory. (2).

*Blow-Pipe Analysis*.—Practice. (1)

*Preparation of Thesis*.

##### SECOND TERM.

*Industrial Chemistry*.—Lectures. (3)

*Industrial Chemistry*.—Laboratory. (3)

*Industrial Chemistry*.—Conference. (1)

*Agricultural Chemistry*.—Laboratory. (1)

*Sanitary Chemistry*.—Laboratory. (1)

*Geology*.—Historic and dynamic geology. Lectures. LeConte. (3)

*Christian Evidences*.—Lectures. (1)

*Preparation of Thesis*. (4)

## THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted; instead of which architectural designing is substituted, as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for masonry structures. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

## FRESHMAN CLASS.

## FIRST TERM.

*See Page 50.*

## SECOND TERM.

*Mathematics.*—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

*Construction.*—Materials. Masonry. Carpentry. Roads and pavements. Sketches of structures. (2)

*Projection Drawing.*—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

*German.*—Grammar and Reader (continued). Short stories by different modern authors. (3) Or *French.*—Grammar and Reader (continued). (3)

*English.*—History of the English language. (2) Essays.

## SOPHOMORE CLASS.

## FIRST TERM.

*Mathematics.*—Differential and integral calculus. (3)

*Mechanics.*—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (2)

*Physics.*—Heat, magnetism, and electricity. Lectures, with study of text-book. (2) Physical laboratory. (1) Electrical laboratory. (1)

*Architectural Drawing.*—Plans of piers and arches. Problems in stone cutting. Use of water colors. (3)

*German.*—Advanced Grammar. Short stories by different modern authors. (2) Or *French.*—Grammar. George Sand: *La Mare au Diable*. Dumas: *Pauline*. (2)

*English.*—American literature. (2) Essays.

## SECOND TERM.

*Mathematics.*—Differential and integral calculus. Differential equations. (4)

*Mechanics.*—Work of first term continued. (2)

*Physics*.—Heat, magnetism, electricity, and light. Lectures. (2) Laboratory. (1)

*Surveying*.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (4)

*German*.—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2) Or *French*.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: Le Cachet Rouge. Dictation. (2)

*English*.—English prose literature. (2) Essays.

## JUNIOR CLASS.

### FIRST TERM.

*Mathematics*.—Hyperbolic trigonometry, theory of errors and least squares. (2)

*Strength of Materials*.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

*Construction*.—Foundations, arches, dams, walls, and bridges. Visits of inspection. (3)

*Perspective Drawing*.—Shades, shadows, and linear perspective. Pen and ink rendering. (4)

*German*.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Or *French*.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

*English*.—English and American Orators. (1)

### SECOND TERM.

*Roofs and Bridges*.—Theory and calculation of stresses in roof and bridge trusses. (5)

*Sanitary Engineering*.—Collection, purification, and distribution of water. Systems of water supply and sewerage. Drainage and sewerage of buildings. (2)

*Architecture*.—Designs and estimates for brick and stone buildings. (4)

*History.*—The history and styles of architecture. (2)  
Lectures on Roman antiquities. (1)

*German or French.*—Readings. Compositions. Lectures on German or French literature. (1) Technical readings. (1)

*English.*—British Essayists. (1)

#### SENIOR YEAR.

##### FIRST TERM.

*Roofs and Bridges.*—Graphic statics. Designs for plate girders, riveted and pin-connected roof trusses, with working drawings. (7)

*Mechanics of Machinery.*—Pile drivers, cranes, and elevators. (2)

*Boilers.*—Strength, construction, and wear and tear of boilers. Wilson. (1)

*Architecture.*—Specifications and estimates. Design for an iron building. (4)

*Heating and Ventilation.*—Systems of heating, lighting, and ventilating buildings. (2)

##### SECOND TERM.

*Hydraulics.*—Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. (3)

*Roofs and Bridges.*—Theory of cantilever, draw, continuous, and arched structures. (3)

*Architecture.*—Building superintendence. The æsthetics of architecture. Plans, specifications. (6)

*Christian Evidences.*—Lectures. (1)

*Preparation of Thesis.* (3)

#### PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon, and evening; in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

## GRADUATING THESES.

Every student is required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses are accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

## DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

## GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

## GRADUATE DEGREES.

## M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same, and present a satisfactory Thesis.

## M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University any Degree in the School of Technology, shall pursue, for at least one year at this University, a course of study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis. Graduates of the Latin-Scientific Course, or of that of Science and Letters, are permitted to study *in absentia* for the degree of M.S., subject to the same restrictions as those prescribed for candidates for the degree of M.A.

The Theses presented by candidates for Graduate Degrees shall be retained by the University.

Applicants for either of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

## THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of \$100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than \$20,000 were contributed by her family and friends as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of \$500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

#### REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

- I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1:30 P.M. until 9:30 P.M.
- II. Admission is free to all persons over 16 years of age.
- III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.
- IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.
- V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.
- VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.
- VII. In taking notes, pencils, and not pen and ink, are to be used.
- VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.
- IX. Any person not conforming to these Regulation will be denied the privilege of the Library.
- X. Any person who defaces, in any way, any book magazine or paper, or the furniture, or

tion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

### OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

### THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Røpper col-

lections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and given by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

### SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of three or four weeks, is held at the University during the long vacation. In 1897 the school will open on Monday, June 21, at 8:30 A.M. Applications to join it should be made to the Professor of Civil Engineering before June 1, 1897. The tuition fee is \$15, payable in advance.

Three courses in Surveying are offered in the Summer School:

*A.* Land and Town Surveying: corresponding to the course given to civil engineering students in the second term of the Sophomore year. This course is open to any student who has completed the Freshman year, or to any person having a good knowledge of geometry and trigonometry.

*B.* Topographical Surveying: corresponding to the course given to civil engineering students in the first term of the Junior year. This course is open to those who have completed course *A* or its equivalent.

*C.* Geodetic Surveying: corresponding to the course given to civil engineering students in the first term of the Senior year. This is open to those who have completed courses *A* and *B*.

At the close of the Summer School examinations are held and certificates given. Students of the University holding these certificates may omit the corresponding work in Surveying during the academic year and may, with the sanction of the Faculty, use the time thus gained in extra studies.

#### THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

#### THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to 1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society since 1890 have been published in "The Lehigh Quarterly."

#### THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Graduate Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

### THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

### THE AGORA

is a literary and debating society which meets semi-monthly. Once restricted in its membership to students in the School of General Literature, in 1893 it was thrown open to all students. It has proved of great advantage to its members in the development of concise and logical thinking, the promotion of ease before an audience, and the acquirement of experience in parliamentary methods. The society has recently joined the Inter-collegiate Debating Union, and it is expected that this will increase the interest already existing, and at the same time enlarge the knowledge of current affairs by the discussion of those subjects of the day which are prescribed by the Union.

### THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

### THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

### THE ARCHITECTURAL CLUB.

This club was formed for the purpose of collecting photographic plates of buildings and plans, and to distribute prints of these among its members. Working drawings, models, and specimens of building materials have also been collected. During the past year a series of monthly competitions in pen and ink drawings was held. The active members of the club are students in the architectural and engineering courses.

### THE MATHEMATICAL CLUB.

This club was organized in February, 1895. Its members are students in the Junior and Senior classes. Its object is to continue the study of higher mathematics after having completed the mathematical course of the University.

### THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life of the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student-body. Those connected with Evangelical churches of whatever creed are eligible to *active membership*; *associate membership* may be claimed by men of good moral standing

who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

### THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the “scientific” or “historical” method to the study of Holy Writ.

### FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University. On Thursday, October 8, 1896, the seventeenth Founder's Day was celebrated. An address was delivered by Mr. John H. Converse, of Philadelphia. His subject was “Citizenship and Technical Education.”

### UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rev. William B. Bodine, D.D., of Philadelphia, was the preacher on Sunday, June 15, 1896, in the Packer Memorial Church.

### THESES.

Theses on the following subjects were prepared by candidates for degrees in 1896:

#### FOR THE DEGREE OF PH. D.

“A Study of some Derivatives of Meta-Diazo-Benzene-Sulphonic Acid, and Action of certain Alcohols on Asym. Meta-Diazo-Xylene-Sulphonic Acid.”

HERMAN EUGENE KIEFER, A. C., M. S.

## FOR THE DEGREE OF E.M.

"A Test of the Efficiency of the Blowing Engines in Use  
by the Crane Iron Co., Catasauqua, Pa."

WILLIAM HENRY BROWN, B.S. (in Mining),

ARTHUR HUGHES LEWIS, B.S. (in Mining).

"The Detwiller Peat Deposit."

JOHN THOMAS CALLAGHAN, JR., B.S. (in Metallurgy).

"A Review of Methods of Working Marbles."

HOWARD ECKFELDT, B.S. (in Metallurgy).

"Investigation of the Taylor Gas Producers at the Works of  
the Lehigh Zinc and Iron Co., South Bethlehem, Pa."

ALBERT BEARDSLEY JESSUP, B.S. (in Mining),

CARLOS YGLESIAS, B.S. (in Mining).

"A Comparison of Glaciated and Non-glaciated Coal Out-  
crops."

JOSEPH PHILIPS, JR., B.S. (in Metallurgy).

## FOR THE DEGREE OF B.A.

"The Roman Senate."

WARREN JOSHUA BIEBER.

"Municipalities: Their Nature, Government, and Present  
Issues."

ROBERT EDWARD LARAMY.

"The Conditions of Roman Literature under Augustus  
and Tiberius."

JOSEPH WHARTON THURSTON.

## FOR THE DEGREE OF B.S.

"Nathaniel Hawthorne."

HOWARD FRANKLIN BOYER.

## FOR THE DEGREE OF C.E.

"Flood Protection for Williamsport, Pa."

ALBERT DOANE AYERS.

"Frogs and Switches within two miles of Bethlehem from  
a mechanical point of view."

LEWIS WARRINGTON BALDWIN.

- "A System of Interlocking Switches and Signals."  
SPRINGFIELD BALDWIN.
- "Plans and Specifications for an Electric Railway from  
South Bethlehem to Hellertown."  
FREDERICK BARTLES.
- "A Treatment of Calculus free from the doubts that  
usually attend it."  
FAIRFAX BAYARD.
- "The Cremation and Reduction of Garbage in Pennsylv-  
ania and New Jersey."  
MORIZ BERNSTEIN.
- "Comparison of Formulas for the Strength of Columns."  
DANIEL WILLIAM BLIEM.
- "Investigation of Coal Storage Trimmers at South Plain-  
field, N.J."  
EDWARD ELISHA BRATTON.
- "The Strength and Economy of several kinds of Metal  
Piles."  
FREDERIC ALLYN DABOLL.
- "Design for a Viaduct from Fountain Hill to New Union  
Station, South Bethlehem, Pa."  
FRANK OLIVER DUFOUR.
- "Plans and Specifications for an Electric Railway from  
Bethlehem to Freemansburg."  
EDWARD MIALl DURHAM, JR.
- "A Steel Mill Building."  
GEORGE RAMSEY ENSCOE.
- "A Review of the Lancaster Reservoir."  
HENRY NEFF HERR.
- "Design for a new Gravity Water Supply for Blainstown,  
N.J."  
ROBERT PARSONS HOWELL.
- "Investigation of the new Arched Bridge at Niagara  
Falls, N.Y."  
VICTOR WITMER KLINE.
- "Frogs and Switches within two miles of Bethlehem from  
a location point of view."  
JOHN BUCKLEY MCBRIDE.

"Design for a Bridge over the Lehigh River at South Bethlehem, Pa."

JOHN HENRY MYERS.

"A Sanitary Survey of the Lehigh Valley."

WALTER RALEIGH OKESON.

"History of the Measurement of the Peruvian Arc."

HORACE LUCIUS PALMER.

"Observations and Discussions of Solar Azimuths."

HOMER AUSTIN REID.

"Investigation of the Tuolumne Dam in California."

GEORGE HOMER RUGGLES.

"History of Bridges over the Lehigh River between Easton and Mauch Chunk."

CLEMENT CLARENCE RUTTER.

"Review of the Water Supply of Allentown, Pa."

JOHN CORNELIUS SESSER.

"Investigation of the Cross Section of the Quaker Bridge Dam."

LUTHER D. SHOWALTER.

"The Flow of Water through Riveted Pipes."

ULYSSES GRANT S. WALTERS.

"Saucon Springs as a Water Supply for South Bethlehem, Pa."

FRANK THOMAS WEILER.

#### FOR THE DEGREE OF M.E.

"A Device for Regulating the Tension on the Feed-Spool of a Rope Twisting Machine."

WILLIAM STEWART AYARS.

"The Design of a Folder for a Web Press."

HOBART BENTLEY AYERS.

"Determination of the Running Balance of Wing's High Speed, Three-Cylinder, Oscillating Engine."

HASELL WILSON BALDWIN.

"A Test to find the Efficiency of a Turbine at Full and Partial Gate Opening."

FRANK SHEPARD BROMER.

"Determination of the Action of a Governor during a Change of Load."

GEORGE AMANDUS BUVINGER,  
HOWARD DRYSDALE HESS.

"Mechanical Stoking versus Hand Firing."

ECKLEY SAMUEL CUNNINGHAM.

"Exact Measurements and their Application to Machine Shop Practice."

SAMUEL PHILIP CURTIS.

"A Comparison of Economics of Steam and Electricity as applied to Railway Transportation."

JOHN WILLIAM DALMAN.

"The Modern Freight Car."

WILLIAM CARTER DICKERMAN.

"The Production of Compressed Air: Theory and Practice."

EDWARD HIRAM DUTCHER, JR.

"Determination of the Coefficient of Discharge and Efficiency of the Crowell Six-Pound Blower."

CHARLES VICTOR FERRIDAY.

"Tests and Discussion of the Performance of a Korting Compound Steam Injector."

THOMAS JOSEPH GANNON.

"Production of Samples of Wet Steam and Determination of their Moisture by the Throttling Calorimeter."

WILLIAM HEALD GROVERMAN.

"The Net and Gross Amount of Power required to run a Bolt and Nut Factory."

CALEB WHEELER LORD.

"Irrigation of Land by Pumping Machinery."

RAFAEL DE LA MORA.

"Mechanical Equivalents in Inventions."

MORRIS WRIGHT POOL.

"The Use and Production of Superheated Steam."

JAMES LEE RANKIN, JR.,  
HENRY SHRIVER, JR.

“Report on the ‘Pitt Equalizing Engine.’”

ARTHUR YEAGER SHEPHERD.

“Design of a Hydro-electric Plant.”

EDWARD STEWART TAYLOR.

“Mechanical Stoking.”

HARRY CONKLIN TRIPP.

#### FOR THE DEGREE OF B.S.

(IN METALLURGY).

“The Utilization of Culm.”

GEORGE POMEROY BARTHOLOMEW.

“Investigation of the Working of Blast Furnace No. 4 of the Bethlehem Iron Co.”

WILLIAM ALVIN EVANS,

VICTOR ALBERT JOHNSON.

“The Manufacture of Sterling Spelter as practised by the Lehigh Zinc and Iron Company.”

EDWARD WILLIAMSON MILLER.

“The Specific Electrical Resistance of Aluminium.”

JOHN AUGUSTUS THOMSON.

“The Empire Gold Mill and Pioneer Reduction Works.”

EDWARD COPPÉE THURSTON.

“The Manufacture and Tinning of Black Plate.”

JOHN SCOFIELD WALLACE.

#### FOR THE DEGREE OF E.E.

“Test of a Tesla Motor.”

WILLIAM JAMES ADAMS,

HENRY PAUL REED.

“Test of a Westinghouse Rotary Transformer.”

ARTHUR DAVISON BADGLEY,

FRANKLIN OBERLY.

“Electric Power Equipment of Mills and Factories.”

FRANCIS HOSKINS BALDWIN,

JOB ROBERTS WILSON.

“Design of an Incandescent Plant for the Pleasant Valley Mine Company’s Buildings.”

CHARLES CHAMPLIN WALKER BAUDER.

"Design of an Electric Light Plant for the Borough of Avondale."

AARON BEAUMONT CARPENTER.

"Electric Car Tests."

MALCOLM CARRINGTON,  
TIMOTHY SHARPE EDEN.

"Reconstruction of an Arc-Light Dynamo."

FRANK LESLIE COOKE.

"Electric Power Transmission from the Anthracite Coal Fields."

CURTIS BERTRAM FLORY,  
WILLIAM STEELL JACKSON.

"Conduit Electric Railways."

CLARENCE RICHARD FOUNTAIN.

"Design and Construction of a Phase-converting Transformer."

JAMES BROWN GIVEN,  
CLIFFORD SHERRON MACCALLA.

"Specifications and Cost of South Bethlehem and Hellertown Railroad."

JOHN SAVAGE GRAFF.

"Development of the Electric Locomotive."

DAVID HALL,  
CHARLES HOWARD MORGAN.

"Applications of Electricity on the St. Paul."

BRUCE EMERSON LOOMIS.

"The Lamb System of Electric Towage as Applied to Canals."

WILLIAM HITZ MUSSEY.

"Design of South Mountain Electric Railroad."

WILLIAM BAILEY TAILOR.

"Plans and Specifications for an Electric Railroad between Bethlehem and Freemansburg."

CURTIS EDWARDS TRAFTON

"Design of a Power Station."

ALFRED MAHLON WORSTALL.

## FOR THE DEGREE OF A. C.

"An Investigation to determine the effect of Oxidizing Agents upon *α*-Meta-Ethoxy-Sulphonamide."

HERBERT HUEBENER BECK.

"Tanning: its Estimation and Relation to Gallic Acid."

MAXIMILIAN JOSEPH BUCHER.

"The Cane Sugar Industry."

ROBERT EDWIN KRESGE.

"The Manufacture and Chemical Analysis of Champagne."

VICTOR EMANUEL MASSON.

"Russian Mineral Glycerine: its Constants, Composition, and Probable Technology."

LOUIS ATWELL OLNEY.

## FOR THE DEGREE OF B. S.

(IN ARCHITECTURE).

"The Ventilation of Modern Residences."

SAMUEL MOSES DESSAUER.

"Design for a Bank Building at Lock Haven, Pa."

JACOB GRAFIUS PETRIKIN.

"Plans for the Main Building of a new Union Depot at South Bethlehem, Pa."

DAVIS SANNO WILLIAMS.

"Plans for the Trainshed of a New Union Depot at South Bethlehem, Pa."

DAVID WILLIAM WILSON, JR.

## UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1897 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 17, 1896.

Reading of Scripture and Prayer by the Rev. Elwood Worcester, Ph.D., Chaplain of the University.

MUSIC.

Salutatory Oration.—"Citizenship."

ROBERT EDWARD LARAMY.

Oration.—“True Education.”

HOBART BENTLEY AYERS.

MUSIC.

Oration.—“America’s Place in Mining Science.”

EDWARD WILLIAMSON MILLER.

Oration.—“War and Civilization.”

HENRY NEFF HERR.

MUSIC.

Oration.—“Applications of Electrical Science.”

CHARLES HOWARD MORGAN.

Valedictory Oration.

WARREN JOSHUA BIEBER.

Award of the Wilbur Scholarship to

HAROLD JOHN HORN,

of South Bethlehem, first in rank in the Sophomore Class.

The Wilbur Prizes were awarded as follows :

Freshman Class, Mathematics, to

JOHN WESLEY GRACE, Jr., of Goshen, N. J.

EUGENE GIFFORD GRACE, of Goshen, N. J.

Freshman Class, French, to

G. FRED ALLEN, of Florida, N. Y.

Freshman Class, German, to

ARTHUR WARNER KLEIN, of Bethlehem.

Freshman Class, Themes, to

MAURICE CLARK BENEDICT, of Altoona.

Freshman Class, Rhetoric, to

CHARLES FORD CARMAN, of Cedarville, N. J.

Freshman Class, Freehand Drawing, to

RUSSELL KIMBALL, of New York City.

Freshman Class, General Chemistry, to

GEORGE REIFSNYDER JACKSON, of Scranton.

The following Degrees were conferred :

PH. D.

HERMAN EUGENE KIEFER, A.C., M.S., South Bethlehem.

E.M.

WILLIAM HENRY BROWN, B.S. (in Mining), Yatesville.

JOHN THOMAS CALLAGHAN, JR., B.S. (in Metallurgy),  
Washington, D. C.

HOWARD ECKFELDT, B.S. (in Metallurgy), Conshohocken.

ALBERT BEARDSLEY JESSUP, B.S. (in Mining), Scranton.

ARTHUR HUGHES LEWIS, B.S. (in Mining), Plains.

JOSEPH PHILIPS, JR., B.S. (in Metallurgy), Nashville, Tenn.

CARLOS YGLESIAS, B.S. (in Mining), San Jose, Costa Rica.

B. A.

WARREN JOSHUA BIEBER, Bethlehem.

ROBERT EDWARD LARAMY, Bethlehem.

JOSEPH WHARTON THURSTON, South Bethlehem.

B. S.

HOWARD FRANKLIN BOYER, Springtown.

C. E.

ALBERT DOANE AYRES, Williamsport.

LEWIS WARRINGTON BALDWIN, Waterbury, Md.

SPRINGFIELD BALDWIN, Baltimore, Md.

FREDERICK RAWDON BARTLES, Williamsport.

FAIRFAX BAYARD, Washington, D. C.

EDGAR TWEEDY BELDEN, Springdale, Conn.

MORIZ BERNSTEIN, Philadelphia.

DANIEL WILLIAM BLIEM, Pottstown.

EDWARD ELISHA BRATTON, Lewistown.

FREDERIC ALLYN DABOLL, Plainfield, N. J.

FRANK OLIVER DUFOUR, Hardesty, Md.

EDWARD MIALl DURHAM, JR., Vicksburg, Miss.

GEORGE RAMSEY ENSCOE, Bennett.

HENRY NEFF HERR, Wheatland Mills.

ROBERT PARSONS HOWELL, Blairstown, N. J.

|                           |                   |
|---------------------------|-------------------|
| VICTOR WITMER KLINE,      | Lockport, N. Y.   |
| JOHN BUCKLEY MACBRIDE,    | Deckertown, N. J. |
| JOHN HENRY MYERS,         | Lewistown.        |
| WALTER RALEIGH OKESON,    | Bethlehem.        |
| HORACE LUCIUS PALMER,     | Frenchtown, N. J. |
| HOMER AUSTIN REID,        | Warren, Ohio.     |
| GEORGE HOMER RUGGLES,     | Cherokee, Iowa.   |
| CLEMENT CLARENCE RUTTER,  | Lansford.         |
| JOHN CORNELIUS SESSER,    | St. Joseph, Mich. |
| LUTHER D. SHOWALTER,      | Pottstown.        |
| ULYSSES GRANT S. WALTERS, | Pottstown.        |
| FRANK THOMAS WEILER,      | Pequea.           |

## M. E.

|                            |                      |
|----------------------------|----------------------|
| WILLIAM STEWART AYARS,     | Wilkes-Barre.        |
| HOBART BENTLEY AYERS,      | Westerly, R. I.      |
| HASELL WILSON BALDWIN,     | Zanesville, O.       |
| FRANK SHEPARD BROMER,      | Schwenksville.       |
| GEORGE AMANDUS BUVINGER,   | Dayton, O.           |
| ECKLEY SAMUEL CUNNINGHAM,  | Drifton.             |
| SAMUEL PHILIP CURTIS,      | Pen Yan, N. Y.       |
| JOHN WILLIAM DALMAN,       | Fort Wayne, Ind.     |
| WILLIAM CARTER DICKERMAN,  | Milton.              |
| EDWARD HIRAM DUTCHER, JR., | South Meriden, Conn. |
| CHARLES VICTOR FERRIDAY,   | South Bethlehem.     |
| THOMAS JOSEPH GANNON,      | South Bethlehem.     |
| WILLIAM HEALD GROVERMAN,   | Ellicott City, Md.   |
| HOWARD DRYSDALE HESS,      | Philadelphia.        |
| CALEB WHEELER LORD,        | Lebanon.             |
| RAFAEL DE LA MORA,         | Guadalajara, Mexico. |
| MORRIS WRIGHT POOL,        | Washington, D. C.    |
| JAMES LEE RANKIN, JR.,     | Savannah, Ga.        |
| *ARTHUR YEAGER SHEPHERD,   | Wilkes-Barre.        |
| HENRY SHRIVER, JR.,        | Cumberland, Md.      |
| EDWARD STEWART TAYLOR,     | Fort Wayne, Ind.     |
| HARRY CONKLIN TRIPP,       | Millerton, N. Y.     |
| HARRY DALLAM WEBSTER,      | Baltimore, Md.       |

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\* Died June 5, having completed the work required for graduation.

## B. S.

(IN METALLURGY).

|                             |                      |
|-----------------------------|----------------------|
| GEORGE POMEROY BARTHOLOMEW, | Jeanesville.         |
| WILLIAM ALVIN EVANS,        | Summit Hill.         |
| VICTOR ALBERT JOHNSON,      | St. Paul, Minn.      |
| EDWARD WILLIAMSON MILLER,   | Bethlehem.           |
| JOHN AUGUSTUS THOMSON,      | Summit Point, W. Va. |
| EDWARD COPPÉE THURSTON,     | South Bethlehem.     |
| JOHN SCOFIELD WALLACE,      | New Castle.          |

## E. E.

|                                 |                        |
|---------------------------------|------------------------|
| WILLIAM JAMES ADAMS, JR.,       | Harrisburg.            |
| ARTHUR DAVISON BADGLEY,         | South Bethlehem.       |
| FRANCIS HOSKINS BALDWIN,        | New Haven, Conn.       |
| CHARLES CHAMPLIN WALKER BAUDER, | Rheims, N. Y.          |
| AARON BEAUMONT CARPENTER,       | Avondale.              |
| MALCOLM CARRINGTON,             | Richmond, Va.          |
| FRANK LESLIE COOKE,             | Hackettstown, N. J.    |
| TIMOTHY SHARPE EDEN,            | Brown's Town, Jamaica. |
| CURTIS BERTRAM FLORY,           | Scranton.              |
| CLARENCE RICHARD FOUNTAIN,      | Washington, D. C.      |
| JAMES BROWN GIVEN,              | Carlisle.              |
| JOHN SAVAGE GRAFF,              | Williamsport.          |
| DAVID HALL,                     | Fayetteville, Tenn.    |
| WILLIAM STEELL JACKSON,         | Duncannon.             |
| BRUCE EMERSON LOOMIS,           | Wilkes-Barre.          |
| CLIFFORD SHERRON MACCALLA,      | Philadelphia.          |
| CHARLES HOWARD MORGAN,          | Maxatawny.             |
| WILLIAM HITZ MUSSEY,            | Washington, D. C.      |
| FRANKLIN OBERLY,                | Easton.                |
| HENRY PAUL REED,                | Fort Schuyler, N. Y.   |
| WILLIAM BAILEY TAYLOR,          | Bethlehem.             |
| CURTIS EDWARDS TRAFTON,         | Fall River, Mass.      |
| JOB ROBERTS WILSON,             | Bethlehem.             |
| ALFRED MAHLON WORSTALL,         | Millville, N. J.       |

## A. C.

|                           |           |
|---------------------------|-----------|
| HERBERT HUEBENER BECK,    | Lititz.   |
| MAXIMILIAN JOSEPH BUCHER, | Columbia. |

|                        |                     |
|------------------------|---------------------|
| ROBERT EDWIN KRESGE,   | South Bethlehem.    |
| VICTOR EMANUEL MASSON, | Hammondsport, N. Y. |
| LOUIS ATWELL OLNEY,    | Providence, R. I.   |

**B. S.**

(IN ARCHITECTURE).

|                            |                      |
|----------------------------|----------------------|
| SAMUEL MOSES DESSAUER,     | Montrose.            |
| JACOB GRAFIUS PETRIKIN,    | Lock Haven.          |
| DAVIS SANNO WILLIAMS,      | Fort Snelling, Minn. |
| DAVID WILLIAM WILSON, JR., | Brooklyn, N. Y.      |

**THE WILBUR SCHOLARSHIP.**

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of \$200 awarded annually to the student in the Sophomore Class having the best record.

**THE ALUMNI SCHOLARSHIP.**

The Alumni Association of the University has established a Scholarship of the value of \$250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any students' course; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

**THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.**

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of \$200, which is to be devoted to the support at the Lehigh University, through-

out his scholastic career, of one student in the School of Mechanical Engineering.

#### THE FRED. MERCUR MEMORIAL FUND SCHOLARSHIPS.

Friends of the late Frederick Mercur, desiring to establish a memorial of their friendship and esteem, and to perpetuate his memory, have contributed and placed in the hands of the Trustees a fund, to be called "The Fred. Mercur Memorial Fund," sufficient in amount to insure the award of several scholarships for free tuition in the University.

#### WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of \$100, for distribution in prizes as the Faculty shall determine.

#### ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed in prizes for excellence in Oratory, subject to the following

#### REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.
2. There shall be a first prize of \$25, a second of \$15, and a third of \$10.
3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.
4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed 1200 words, taking about eight minutes in delivery.
5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of

the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do—should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

## ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1896.

## I.—ENGLISH.

## I. GRAMMAR.

Be very careful about spelling, punctuation and division into paragraphs.

1. Of what does English Grammar treat? Why should it be studied by those who speak English?

2. Define Orthography, Etymology, Syntax and Prosody.

3. Define a Noun. How many sorts of nouns are there? What difference in their spelling?

4. Define a Letter, a Syllable and a Word.

5. Name the Ten Parts of Speech. Which are absolutely necessary to form a sentence?

6. Define a Sentence, a Clause, a Principal Clause, a Subordinate Clause. Write a complex sentence.

7. How are adjectives compared? What words are modified by adverbs? How are participles to be parsed in a sentence?

8. Decline all the Personal Pronouns.

9. Define a Strong Verb, a Weak Verb, an Irregular Verb, a Defective Verb. How are verbs divided with respect to their meaning?

10. Write the principal parts of the verbs: love, walk, swim, slay, teach, reach, meet, sing, swing, tell, write, catch, shrink, sink, be, beware, shall, will, ought, seethe.

11. Analyze the following sentences, correct them if necessary, and parse words in italics:

a. Every one must judge of their *own* feelings.

b. Observe them in the *order* they stand,

c. *Please* excuse my son's absence.

d. And so would I, if *I* were *he*.

e. Children should know that it is their duty to honor their *parents*, to ask advice of them, and to observe their wishes of whatever sort they may *be*.

12. Turn this into simple prose.

"Heaven from all creatures hides the book of fate,

All but the page prescribed, their present state ;

From brutes what men, from men what spirits know ;

Or who could suffer being here below ?"

Then, put it all into one orderly complex sentence.

## II. RHETORIC.

Write slowly and distinctly. Make each answer complete and a model of clearness and precision.

I. Define Rhetoric. Is it a science or an art? Compare it, in this respect, with grammar and logic.

II. What is the province of Style? Its most essential element? Define Style. What is individuality in Style?

III. Define diction. What cautions are to be observed about "present use" of words? About Latin or Saxon words? About provincial, technical and archaic words?

IV. What are figures of speech? When is their use appropriate? What figures promote clearness and concreteness? What is an abstract idea?

V. State the essentials of a good definition. Define any three common nouns on that plan. Define a *rule* and a *concrete example*.

VI. State the rhetorical value of a Simile and a Metaphor. How do they differ? Upon what relation is Metonymy based? What are the natural defects of Allegory?

VII. Meanings of Allegory, Personification, Antithesis; upon what principle is the latter based? What are a climax and an anti-climax? Is the latter ever allowable?

VIII. What is meant by Suspension? What is a balanced sentence; a loose sentence; a periodic sentence?

What are synonyms, and on what principle are they to be distinguished and used? What are homonyms?

IX and X. Write a short piece of descriptive prose of not more than 200 words on one of the following subjects:

1. The Forest of Arden.
2. London Streets during the Plague.
3. Buckthorne's Estate in the Hands of the Booby Squire.
4. The Adventure at the Inn of Terracina.
5. Silas Marner's Home.

## II.—GEOGRAPHY.

Outline maps of the Central part of the United States, and of Western Asia, were furnished to each applicant, and he was required to draw the boundaries of countries, provinces, states and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

## III.—UNITED STATES HISTORY.

1. What was the last important battle that settled the supremacy of the English over the French on the American continent.

2. What were the "Articles of Confederation," and when were they adopted?

3. What were the leading events of John Adams' administration?

4. Give the leading events, domestic and foreign, of the two terms of Monroe's administration.

5. *a*) What occasioned the Missouri compromise? *b*) What were its provisions?

6. What were the four parties at the presidential election of 1860? and who were the candidates?

7. What caused the expedition of John Brown? when and where did it take place?

8. Who declares war in the United States, and who makes peace?

9. How is a vacancy caused by the removal, death, resignation or inability of the Vice-President to be provided for?

10. How are the states protected?

#### IV.—ARITHMETIC.\*

I.  $(\frac{3}{4} + \frac{17}{18} + 1.075) \div (24\frac{3}{4} - 16.792 - \frac{7}{5}) = ?$

II. 5 miles,  $10\frac{1}{2}$  rods, 3 ft.  $2\frac{1}{3}$  in.; how many centimeters?

III. Find the interest, true discount, and bank discount on \$27 for 90 days at  $5\frac{1}{2}\%$ .

IV. (a) At what price must a 6% stock be bought to pay 8% on the investment?

(b) Find present worth of a 6% note for \$313, which has been running 3 months and is due in 6 months, money being worth 5% in the market?

V. How many bushels will a bin 3 ft. 6 in. x 2 ft. 6 in. x 6 ft. hold? How many gallons if it is a water tank?

VI. Give the number of sq. ft. in an acre; sq. chains in an acre; chains in a mile. How is the lineal unit (yard) determined? State the rule for fixing the decimal point in multiplication and division, and give the reason for it.

#### V.—GEOMETRY.

1. a. Show what is the locus of all points equally distant from the sides of an angle.

b. Show what three bisectors of the angles of a triangle, both interior and exterior, meet in a common point.

2. Show what is the measure of an angle formed by two intersecting chords, whether they intersect within or without the circle.

\*In 1897, and thereafter, Arithmetic will not be required for admission to the University.

3. Show how to divide a line internally in the ratio 3:4 and externally in the ratio 4:7.
4. *a.* Show how to construct a square equal to  $\frac{2}{3}$  of a given square.  
*b.* Of all plane figures with the same area the circle has the least perimeter.
5. Show how to inscribe a regular decagon in a circle.
6. Two rectangles with equal bases are to each other as their altitudes. (Both cases.)
7. Show how to compute the ratio of a circumference to its diameter.
8. *a.* If a plane is perpendicular to one of two parallel lines it is perpendicular to the other.  
*b.* If a line is perpendicular to one of two parallel planes it is perpendicular to the other.
9. The sum of two face angles of a trihedral angle is greater than the third.
10. *a.* State when a line is divided harmonically; when in extreme and mean ratio. What is meant by the angle between two lines that do not intersect?  
*b.* Define a continued proportion. When are four quantities said to be proportional? When are three? When two?  
*c.* State the various conditions that will cause two triangles to be similar. How do similar polygons compare?

## VI.—ALGEBRA.

1. Reduce to forms having rational denominators :

$$\frac{3}{\sqrt{3} + \sqrt[3]{5}}; \frac{1 + \sqrt{-1}}{1 - \sqrt{-1}}; \frac{x}{\sqrt[3]{-y^2}}; \frac{x}{\sqrt[3]{(-y)^2}};$$

$$\frac{a}{\sqrt{b} + \sqrt{c} + \sqrt{d}}$$

2. Expand  $(x^{-\frac{1}{2}} - y^{\frac{1}{3}})^{-\frac{1}{4}}$  and  $(x^2 - y^2)^{\frac{1}{2}}$  to five terms by binomial formula.

3. Show that  $x^n - y^n$  is divisible by  $x - y$ , and show what the statement becomes when  $y$  is negative.

4. Solve  $\frac{5x - 9}{\sqrt{5x} + 3} - 1 = \frac{\sqrt{5x} - 3}{2}$ . Verify.

Given  $a$ ,  $n$ , and  $l$ , of a geometrical progression to find  $s$ .

5. Solve  $x + y = 4$ ,      Also  $x^2 + xy = 12$ ,  
 $\frac{1}{x} + \frac{1}{y} = 1$ .       $xy + y^2 = 2$ .

6. Solve  $\sqrt{x - \frac{1}{x}} + \sqrt{x - \frac{1}{x}} = x$ .

Also  $\sqrt{x + 8} - \sqrt{x + 3} = \sqrt{x}$ . Verify.

7. A and B together can do a piece of work in 12 days, B and C in 20 days, and A and C in 15 days. How long will it take each to do it, and how long for all to do it working together?
8. The sides of a rectangle are 8 and 6. Required the sides of another rectangle having twice its area and twice its perimeter.
9. Solve  $x^2 + y^2 + x + y = 18$ ,  $xy = 6$ .  
 Also  $x^2 + y^2 = 12$ ,  $xy = 20$ .  
 How is it seen at once that  $x$  and  $y$  in the latter are imaginary?
10. (a) State the conditions and give the rules for simplifying a radical.
- (b) What equations may be solved as quadratics? Define an arithmetical progression and give the formulæ belonging to it.
- (c) Give the rules for algebraic signs in multiplication and division and the reasons for them. State the distinction between terms and factors.

## VII.—PHYSICS.

## 1. Define :

- a.* Momentum ;
- b.* Dyne ;
- c.* Center of Gravity ;
- d.* Length of a Pendulum ;
- e.* Electrostatic Unit of Capacity ;
- f.* Coulomb ;
- g.* Beats ;
- h.* Timbre ;
- i.* Evaporation ;
- j.* Latent Heat of Vaporization ;
- k.* Conjugate Foci ;
- l.* Dispersion.

2. *a.* What is the difference between a gas and a vapor ?

- b.* Explain by means of diagrams (1) how the resultant of several forces is found, and (2) how to resolve a force into two components.

## 3. A body weighing 10 pounds is projected vertically upward with a velocity of 289.44 feet per second.

- a.* How high will it rise ?

- b.* What heat in lesser calories will be developed upon impact with the earth on its descent ?

4. *a.* State Mariott's Law.

- b.* A hydrostatic press has lever arms 1 and 5 feet respectively and pistons of 2 and 10 inches diameter respectively. What pressure can be obtained at the large piston by a power of 100 lbs. on the lever, allowing a loss of 10% by friction ?

5. *a.* State the differences between a sound wave and a water wave ; between noise and music.

- b.* What constitutes the tone of an organ pipe, and upon what does its pitch depend ?

## 6. A copper calorimeter weighing 20.31 grams contains 30.17 g. of water at 23°C. A piece of silver weighing 40.22 g.

is heated to  $98^{\circ}$  and dropped into the water in calorimeter. The resulting temperature of calorimeter and contents is found to be  $28^{\circ}\text{C}$ . Calculate the specific heat of silver. (Specific heat of copper = .095.)

7. *a.* What is the difference between heat and temperature?

*b.* Explain the three ways of diffusing heat.

8. *a.* What is the velocity of light?

*b.* State Laws of Refraction.

*c.* With a double convex lens where is the image when object is beyond secondary focus? Show by diagrams how this fact is made use of in either the photographic camera or the telescope.

9. A copper wire 300 ft. long and 9 mils in diameter has the same resistance as 554 ft. of silver wire 12 mils in diameter. Taking the conductivity of silver as 1, compute the conductivity of copper.

10. Given 8 cells each of an E.M.F. of 2 volts and internal resistance of  $\frac{1}{2}$  ohm. Determine the most efficient grouping with an external resistance of 8 ohms. What will be the current in amperes and the power in watts when thus grouped?

## VIII.—LATIN.

### I. GRAMMAR.

Decline *dea*, *os* (a bone), *mare*, *domus*, *acies*, *iste*, *duo*, *nequam*, *uterque*.

Compare *felix*, *gracilis*, *vetus*.

Write the ordinal numerals from one to ten.

Give the full synopsis of *audeo*, *audio*, *cipio*, *fio*.

Give all the participles of *hortor*.

State the gender of the following words with the reason for such as come under special rules: *quercus*, *nauta*, *virus*, *alvus*.

Derive adverbs from the following adjectives and compare them: *audax*, *verus*, *bonus*.

What are the varieties of the Conditional Sentence?

What cases follow these words: *memini*, *persuadeo*, *vescor*, *dignus*?

Give the rules which govern the Indirect Discourse, both for principal and secondary clauses.

## II. CAESAR.

*Translate (Bk. I., § 34):*

Ei legationi Ariovistus respondit: si quid ipsi a Caesare opus esset, sese ad eum venturum fuisse; si quid ille se velit, illum ad se venire oportere. Praeterea se neque sine exercitu in eas partes Galliae venire audere, quas Caesar possideret, neque exercitum sine magno commeatu atque molimento in unum locum contrahere posse. Sibi autem mirum videri, quid in sua Gallia, quam bello vicisset, aut Caesari aut omnino populo Romano negotii esset.

Write the verbs here used, changing them into the tenses of the Direct Discourse.

*Translate (Bk. IV., § 7):*

Re frumentaria compara equitibusque delectis iter in ea loca facere coepit, quibus in locis esse Germanos audiebat. A quibus cum paucorum dierum iter abesset, legati ab his venerunt, quorum haec fuit oratio: Germanos neque priores populo Romano bellum inferre neque tamen recusare, si lacescantur, quin armis contendant, quod Germanorum consuetudo sit a maioribus tradita, quicumque bellum inferant, resistere neque deprecari. Haec tamen dicere, venisse invitos, ejectos domo.

Give nominative singular of *loca*. Give syntax of *iter* and *domo*.

## III. VERGIL.

*Translate (Bk. II., line 57):*

Ecce, manus iuvenem interea post terga revinctum  
pastores magno ad regem clamore trahebant  
Dardanidae, qui se ignotum venientibus ultro,

hoc ipsum ut strueret Troiamque aperiret Achivis,  
 obtulerat, fidens animi atque in utrumque paratus,  
 seu versare dolos, seu certae occumbere morti.

Give principal parts of *trahebant* and *occumbere*. What is the syntax of *animi*?

*Translate (Bk. IV., line 607):*

Sol, qui terrarum flammis opera omnia lustras,  
 tuque harum interpres curarum et conscia Iuno,  
 nocturnisque Hecate triviis ululata per urbes,  
 et Dirae ultrices, et di morientis Elissae,  
 accipite haec, meritumque malis advertite numen,  
 et nostras audite preces.

What is the connection of this passage?

Write out the first three lines, marking the quantity of each syllable, separating the feet, and indicating the caesura.

*Translate (Bk. VI., line 124):*

Talibus orabat dictis, arasque tenebat,  
 cum sic orsa loqui vates: 'Sate sanguine divom,  
 Tros Anchisiade, facilis descensus Averno;  
 noctes atque dies patet atri ianua Ditis;  
 sed revocare gradum superasque evadere ad auras,  
 hoc opus, hic labor est.'

Explain the syntax of *sanguine* and *Averno*.

#### IV. CICERO.

*Translate (In Catilinam Or. II.):*

Quod expectavi, iam sum adsecutus, ut vos omnes factam esse aperte coniurationem contra rem publicam videretis: nisi vero si quis est qui Catilinae similis cum Catilina sentire non putet. Non est iam lenitati locus: severitatem res ipsa flagitat. Unum etiam nunc concedam: exeant, proficiscantur; ne patiantur desiderio sui Catilinam miserum tabescere. Demonstrabo iter: Aurelia via profectus est: si adcelerare volent, ad vesperam consequentur.

(*In Catilinam Or. IV*):

Quae cum ita sint, patres conscripti, vobis populi Romani praesidia non desunt; vos ne populo Romano deesse videamini providete. Habetis consulem ex plurimis periculis et insidiis atque ex media morte, non ad vitam suam, sed ad salutem vestram reservatum. Omnes ordines ad conservandam rem publicam mente, voluntate, voce consentiunt.

(*Manilian Law*):

Est haec divina atque incredibilis virtus imperatoris. Quid ceterae, quas paulo ante commemorare coeperam, quantae atque quam multae sunt? Non enim bellandi virtus solum in summo ac perfecto imperatore quaerenda est, sed multae sunt artes eximiae huius administrae comitesque virtutis. Ac primum, quanta innocentia debent esse imperatores? quanta deinde in omnibus rebus temperantia? quanta fide? quanta facilitate? quanto ingenio? quanta humanitate?

#### V. SIGHT.

*Translate :*

Conatus est Caesar reficere pontes: sed nec magnitudo fluminis permittebat, neque ad ripam dispositae cohortes adversariorum perfici patiebantur; quod illis prohibere erat facile cum ipsius fluminis natura atque aquae magnitudine, tum quod ex totis ripis in unum atque angustum locum tela iaciebantur; atque erat difficile eodem tempore rapidissimo flumine opera perficere et tela vitare.

#### VI. PROSE COMPOSITION.

*Translate into Latin :*

Caesar sent his lieutenant to see in what direction the enemy were making their march. He reported that the Germans were two miles away with all their forces. Caesar fortified a camp and early in the morning gladly drew up his line of battle before the camp on the top of a hill. After a fierce battle he routed the enemy with the loss of six hundred of his soldiers.

## VII. ROMAN HISTORY.

1. Give the names of the traditional kings of Rome with an account of the abolition of regal power.
2. Describe the Latin War and give its date.
3. Mention the causes of the First Punic War, with date.
4. Describe the career of Hannibal.
5. Give the life of Marius.

## IX.—GREEK.

## I. GRAMMAR.

1. Decline, through all numbers : ἡ στάσις, ὁ ἱερεὺς, τὸ μέλος, σωτήρ, ἀνήρ; through all numbers and genders : μέλας, ἀπλοῦς, μέγας.

2. Give comparative and superlative forms of : μέσος, σώφρων, ἐχθρός, κακός, ῥάδιος, ταχέως.

3. Give the aorist indicative active, singular and plural, of ἵημι; the perfect indicative active, singular and plural, of ἵστημι.

4. Give a synopsis (first person singular of each mood) of the present of εἶμι and of εἰμί; the future active of μένω; the future middle of κομίζω; the aorist active of γινώσκω; the aorist middle of δίδωμι; the aorist passive of στέλλω; the perfect active of οἶδα.

5. Name three classes of verbs that are used with the Genitive.

6. Name two prepositions that are used with Genitive, Dative, and Accusative, and give meaning of each with each case.

7. *Translate :*

εἰ ἦλθες, αὐτὸν ἂν εἶδες.  
 εἰ ἔλθοις, αὐτὸν ἂν ἴδοις.  
 ἐὰν ἔλθῃς, αὐτὸν ὀψεί.

8. *Translate :*

φαίνεται ἀγαθὸς ὢν.  
 φαίνεται ἀγαθὸς εἶναι.

9. *Translate :*

οἶδα γράφειν.  
 οἶδα γράφων.

## II. XENOPHON.

1. *Translate :*

εἰ δέ τινα ὄρῃη δεινὸν ὄντα οἰκονόμον ἐκ τοῦ δικαίου καὶ κατασκευάζοντά τε ἧς ἄρχοι χώρας καὶ προσόδους ποιοῦντα, οὐδένα ἂν πώποτε ἀφείλετο, ἀλλ' αἰεὶ πλείω προσεδίδουν· ὥστε καὶ ἡδέως ἐπόνουν καὶ θαρραλέως ἐκτῶντο καὶ ὃ ἐπέπατο αὐτὸς τις ἡκιστα Κῦρον ἐκρυπτεν· οὐ γὰρ φθονῶν τοῖς φανερώς πλουτοῦσιν ἐφαίνετο, ἀλλὰ πειρώμενος χρῆσθαι τοῖς τῶν ἀποκρυπτομένων χρήμασι· φίλους γε μὴν ὅσους ποιήσαιο καὶ εὖνους γνοίη ὄντας καὶ ἱκανοὺς κρίνειε συνεργοὺς εἶναι ὃ τι τυγχάνοι βουλόμενος κατεργάζεσθαι, ὁμολογεῖται πρὸς πάντων κράτιστος δὴ γενέσθαι θεραπεύειν. καὶ γὰρ αὐτὸ τοῦτο οὐπερ αὐτὸς ἔνεκα φίλων ᾤετο δεῖσθαι, ὥς συνεργοὺς ἔχοι, καὶ αὐτὸς ἐπειράτο συνεργὸς τοῖς φίλοις κράτιστος εἶναι τοῦτου ὅτου ἕκαστον αἰσθάνοιτο ἐπιθυμοῦντα·

Explain the construction (1) of each genitive, (2) of each dative, (3) of οὐδένα (l. 2) and Κῦρον (l. 4), (4) of each optative.

Analyze every contracted syllable.

Which rules of accentuation are illustrated in the first sentence as far as ποιοῦντα ?

2. *Translate :*

ἀπορουμένοις δ' αὐτοῖς προσελθὼν τις ἀνὴρ Ῥόδιος εἶπεν· Ἐγὼ θέλω, ὦ ἄνδρες, διαβιβάσαι ὑμᾶς κατὰ τετρακισχιλίους ὀπλίτας, ἂν ἐμοὶ ὦν δέομαι ὑπηρετήσητε, καὶ τάλαντον μισθὸν πορίσητε. ἐρωτώμενος δὲ ὅτου δέοιτο, Ἀσκῶν, ἔφη, δισχιλίων δεήσομαι· πολλὰ δ' ὥρῳ πρόβατα καὶ αἰγας καὶ βοῦς καὶ ὄνους, ἃ ἀποδαρέντα καὶ φνσηθέντα ῥαδίως ἂν παρέχοι τὴν διάβασιν· δεήσομαι δὲ καὶ τῶν δεσμῶν οἷς χρῆσθε περὶ τὰ ὑποζύγια· τούτοις ζεύξας τοὺς ἄσκους πρὸς ἀλλήλους, ὁρμίσας ἕκαστον ἄσκον λίθους ἀρτήσας καὶ ἀφείς ὥσπερ ἀγκύρας εἰς τὸ ὕδωρ, διαγαγὼν καὶ ἀμφοτέρωθεν δῆσας, ἐπιβαλὼν ὕλην καὶ γῆν ἐπιφορήσω· ὅτι μὲν οὖν οὐ καταδύσεσθε αὐτίκα μάλα εἰσεσθε· πᾶς γὰρ ἄσκος δύο ἄνδρας ἔξει τοῦ μὴ καταδύναι· ὥστε δὲ μὴ ὀλισθάνειν ἢ ὕλην καὶ ἢ γῆν σχήσει.

At what point in the history of the Expedition does the above incident occur ?

3. *Translate, at sight :*

Καὶ ἀφικνοῦνται ἐπὶ τὸ ὄρος τῇ πέμπτῃ ἡμέρᾳ· ὄνομα δὲ τῇ ὄρει ἦν Θήχης. ἐπεὶ δὲ οἱ πρῶτοι ἐγένοντο ἐπὶ τοῦ ὄρους καὶ κατείδον τὴν θάλατταν, κραυγὴ πολλὴ ἐγένετο. . . . ἐπειδὴ δὲ βοῇ πλείων τετέγι-

γνετο καὶ ἐγγύτερον, καὶ οἱ αἰεὶ ἐπιόντες ἔθεον δρόμῳ ἐπὶ τοὺς αἰεὶ βοῶντας, καὶ πολλῷ μείζων ἐγίγνετο ἡ βοή ὅσῳ δὴ πλείους ἐγίνοντο, ἐδόκει δὲ μείζον τι εἶναι τῷ Ξενοφῶντι. καὶ ἀναβὰς ἐφ' ἵππον, καὶ Λύκιον καὶ τοὺς ἱππέας ἀναλαβὼν, παρεβοήθει· καὶ τάχα δὲ ἀκούουσι βοῶντων τῶν στρατιωτῶν Θάλαττα, Θάλαττα, καὶ παρεγγύνωντων. ἔνθα δὲ ἔθεον πάντες καὶ οἱ ὀπισθοφύλακες, καὶ τὰ ὑποζύγια ἡλαύνετο καὶ οἱ ἵπποι. ἐπεὶ δὲ ἀφίκοντο πάντες ἐπὶ τὸ ἄκρον, ἐνταῦθα δὲ περιέβαλλον ἀλλήλους καὶ στρατηγούς καὶ λοχαγούς δακρύοντες. καὶ ἑξαπίνης, ὅτου δὲ παρεγγύησαντος, οἱ στρατιῶται φέρουσι λίθους καὶ ποιοῦσι κολωνὸν μέγαν.

Θάλαττα : sea.

παρεγγνάω : pass the word along.

περιβάλλω : embrace.

κολωνός : mound.

### III. HOMER.

#### 1. Translate :

“Ζεῦ πάτερ, εἶποτε δὴ σε μετ' ἀθανάτοισιν ὄνησα  
ἢ ἔπει ἢ ἔργῳ, τόδε μοι κρήνην ἐέλωρ·  
τίμησόν μοι νῖδον, ὃς ὠκυμορώτατος ἄλλων  
ἔπλετ'· ἀτάρ μιν νῦν γε ἀναξ ἀνδρῶν Ἀγαμέμνων  
ἠτίμησεν· ἐλὼν γὰρ ἔχει γέρας, αὐτὸς ἀπούρας.  
ἀλλὰ σύ περ μιν τίσων, Ὀλύμπιε μητίετα Ζεῦ·  
τόφρα δ' ἐπὶ Τρώεσσι τίθει κράτος, ὄφρ' ἂν Ἀχαιοὶ  
νῖδον ἐμὸν τίσωσιν, ὀφέλλωσιν τέ ἐ τιμῇ.”

Name all Epic forms, giving the equivalent Attic ones.

#### 2. Translate :

“ὦ πόποι, ἣ δὴ παισὶν εἰκότες ἀγοράασθε  
νηπιάχοις, οἷς οὔτι μέλει πολεμῆμα ἔργα.  
πῇ δὲ συνθεσῖαι τε καὶ ἔρκια βήσεται ἡμῖν;  
ἐν πυρὶ δὲ βουλαί τε γενοίατο μήδεά τ' ἀνδρῶν,  
σπονδαὶ τ' ἄκρητοι καὶ δεξιαί, ἥς ἐπέπιθμεν·  
αὐτῶς γάρ ῥ' ἐπέεσσ' ἐριδαίνομεν, οὐδέ τι μῆχος  
εὐρέμεναι δυνάμεσθα, πολλὸν χρόνον ἐνθάδ' ἐόντες.”

Mark quantities of syllables, divisions into feet, and caesuras.

#### 3. Translate :

Δεύτερον αὖτ' Ὀδυσῆα ἰδὼν ἐρέειν ὁ γεραίός.  
“εἶπ' ἄγε μοι καὶ τόνδε, φίλδον τέκος, ὅστις ὅδ' ἐστίν.  
μείων μὲν κεφαλῇ Ἀγαμέμνονος Ἀτρεΐδαι,

εὐρύτερος δ' ὤμοισιν ἰδὲ στέρνοισιν ἰδέσθαι.  
 τεύχεα μὲν οἱ κεῖται ἐπὶ χθονὶ πολυβοτείρῃ,  
 αὐτὸς δὲ κτίλος ὥς ἐπιπώλειται σίχας ἀνδρῶν·  
 ἀρνειῶ μιν ἔγωγε εἴσκω πηγεσιμάλλῃ,  
 ὥς τ' οἶων μέγα πῶν διέρχεται ἀργεννάων."

Τὸν δ' ἡμείβετ' ἔπειθ' Ἑλένη Διὸς ἐκγεγαυῖα·  
 "οὗτος δ' αὖ Λαερτιάδης, πολύμητις Ὀδυσσεύς,  
 ὃς τράφη ἐν δήμῳ Ἰθάκης κραναῇς περ ἐούσης,  
 εἰδὼς παντοίους τε δόλους καὶ μῆδεα πυκνά."

Describe the circumstances under which this conversation was held.

#### IV. HISTORY.

1. Describe the legislation ascribed to Lycurgus at Sparta.
2. Give an account, with dates, of all occasions on which the Persians and the European Greeks came in contact with each other.
3. Name three of the leading men on each side in the Peloponnesian War and describe their characters.
4. Give an account of the supremacy of Thebes.
5. Give an account of the political life of Demosthenes.

## STUDENTS.

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|                            |                              |
|----------------------------|------------------------------|
| Clas.—Classical.           | C.E.—Civil Engineering.      |
| L.S.—Latin-Scientific.     | E.M.—Mining Engineering.     |
| Sci.—Science and Letters.  | M.E.—Mechanical Engineering. |
| A.C.—Analytical Chemistry. | E.E.—Electrical Engineering. |
| Arch.—Architecture.        |                              |

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## GRADUATE STUDENTS.

|                         | FOR DEGREE.       | RESIDENCE.            |
|-------------------------|-------------------|-----------------------|
| Wm. N. R. Ashmead,      | B.A., M.A.,       | Philadelphia.         |
| Henry M. S. Cressman,   | B.A., M.A.,       | Egg Harbor City, N.J. |
| Eckley S. Cunningham,   | M.E., M.S.,       | Drifton.              |
| Walter Joseph Dech,     | B.A., M.A.,       | Bethlehem.            |
| Charles M. Douglas,     | B.A., M.A.,       | New York City.        |
| William H. Hoffman,     | B.C.E., M.S.,     | Lafayette, Ind.       |
| Elmer Augustus Jacoby,  | B.A., M.A.,       | Bethlehem.            |
| Charles Lincoln Keller, | M.E., M.S.,       | Chicago, Ill.         |
| William Allen Lambert,  | B.A., M.A.,       | Philadelphia.         |
| Harry K. Landis,        | B.S., E.M., M.S., | New York City.        |
| E. Williamson Miller,   | B.S., E.M.,       | Bethlehem.            |
| Harlan Sherman Miner,   | A.C., M.S.,       | Gloucester, N.J.      |
| Howard Segar Neiman,    | A.C., M.S.,       | Albany, N.Y.          |
| David Kirk Nicholson,   | M.E., M.S.,       | Braddock.             |
| Samuel Arthur Rhodes,   | E.E., M.S.,       | Austin, Ill.          |
| Ira A. Shimer,          | B.A., M.A.,       | Philadelphia.         |
| John Eugene Stocker,    | B.S., M.S.,       | Upper Alton, Ill.     |
| John Augustus Thomson,  | B.S., E.M.,       | Summit Point, W. Va.  |

## SENIOR CLASS.

|                              | COURSE. | RESIDENCE.            |
|------------------------------|---------|-----------------------|
| Francis DuPont Ammen,        | M.E.,   | Ammendale, Md.        |
| Henry Jonathan Biddle Baird, | E.M.,   | West Chester.         |
| Lathrop Hutchings Baldwin,   | M.E.,   | Allentown.            |
| Charles Marshall Barton,     | C.E.,   | Pikesville, Md.       |
| Frank Breckenridge Bell,     | M.E.,   | Mercer.               |
| Harry Layfield Bell,         | E.E.,   | Norfolk, Va.          |
| William Ragan Binkley,       | E.E.,   | Hagerstown, Md.       |
| Bertine Frederic Borhek,     | A.C.,   | West Bethlehem.       |
| Charles Schwartze Bowers,    | E.E.,   | Philadelphia.         |
| John Boyt,                   | E.M.,   | Adamsford.            |
| William Burke Brady,         | M.E.,   | Harrisburg.           |
| Walter Everette Brown,       | E.E.,   | Stamford, Conn.       |
| Sinclair Wiggins Chiles,     | C.E.,   | Sims City, Fla.       |
| Thomas Holland Clagett,      | E.M.,   | Berryville, Va.       |
| Barton Olmsted Curtis,       | C.E.,   | Monona, Iowa.         |
| Patrick Edward Dinan,        | A.C.,   | South Bethlehem.      |
| Louis Diven,                 | E.E.,   | Elmira, N. Y.         |
| Benjamin Irvin Drake,        | E.M.,   | Chicago, Ill.         |
| Clifford George Dunnells,    | C.E.,   | Pittsburg.            |
| Stuart Rhett Elliott,        | E.M.,   | Beaufort, S. C.       |
| Albert Andrew Finkh,         | M.E.,   | Yonkers, N. Y.        |
| Ira D. Fulmer,               | E.E.,   | Richland Centre.      |
| Francisco Martinez Gallardo, | M.E.,   | Guadalajara, Mex.     |
| Orrin Satterlee Good,        | E.E.,   | Lock Haven.           |
| Ralph Scofield Griswold,     | E.E.,   | Madison, N. J.        |
| John Lewis Gross,            | M.E.,   | Wilkes-Barre.         |
| William Thomas Hanly,        | C.E.,   | Philadelphia.         |
| William Stephen Hiester,     | E.E.,   | Harrisburg.           |
| Ross Nathaniel Hood,         | E.E.,   | Duncannon.            |
| Oliver Zell Howard,          | M.E.,   | Hagerstown, Md.       |
| Henry Taylor Irwin,          | M.E.,   | Allegheny.            |
| Arthur Perkins Jenks,        | E.E.,   | Yardley.              |
| Harry Sackett Johnson,       | E.E.,   | East Aurora, N. Y.    |
| Lawrence Rust Lee,           | M.E.,   | Shepherdstown, W. Va. |

|                                | COURSE. | RESIDENCE.           |
|--------------------------------|---------|----------------------|
| Telford Lewis,                 | E.M.,   | Blairsville.         |
| Charles Victor Livingston,     | E.E.,   | Kingston, N.Y.       |
| Arthur Frost Loomis,           | E.E.,   | Oneida, N.Y.         |
| Barry MacNutt,                 | E.E.,   | Bethlehem.           |
| James Gordon Mason,            | E.M.,   | West Pittston.       |
| William Adams Megraw,          | M.E.,   | Baltimore, Md.       |
| Esteban A. Mercenario,         | C.E.,   | Puebla, Mex.         |
| Thaddeus Merriman,             | C.E.,   | South Bethlehem.     |
| Frank Douglass Mount,          | C.E.,   | Manasquan, N.J.      |
| Carl Pivany Nachod,            | E.E.,   | Glenside.            |
| Henry H. Newton,               | M.E.,   | Guadalajara, Mexico. |
| Robert Collyer Noerr,          | C.E.,   | Washington, D.C.     |
| Harry Richards Peck,           | M.E.,   | Scranton.            |
| James Harkins Pennington,      | M.E.,   | Philadelphia.        |
| Morris Havens Putnam,          | M.E.,   | Tioga.               |
| John Peake Reynolds, jr.,      | M.E.,   | Charleston, S.C.     |
| Robert Porterfield Richardson, | A.C.,   | Easton.              |
| Samuel Stewart Riegel,         | M.E.,   | South Bethlehem.     |
| Eugene Peronnean Roundey,      | C.E.,   | East Orange, N.J.    |
| Woodford Royce,                | M.E.,   | Willimantic, Conn.   |
| Auguste Leopold Saltzman,      | M.E.,   | Plainfield, N.J.     |
| Charles Fred. Sanders,         | C.E.,   | Kutztown.            |
| Charles Francis Scott,         | E.E.,   | New York City.       |
| Henry Hamilton Seabrook,       | E.E.,   | Beaufort, S.C.       |
| Samuel Palmer Senior,          | C.E.,   | Washington, D.C.     |
| Arthur Harold Serrell,         | E.E.,   | Plainfield, N.J.     |
| Frank Bradley Sheaffer,        | C.E.,   | New Bethlehem.       |
| John Leefe Sheppard, jr.,      | M.E.,   | Charleston, S.C.     |
| Edward Peter Shuman,           | C.E.,   | Allentown.           |
| Jonathan Edward Slade,         | C.E.,   | Chicago, Ill.        |
| Michael Thomas Stack,          | C.E.,   | Shenandoah.          |
| Alvin Riegel Sterner,          | E.E.,   | Bethlehem.           |
| John Stewart, jr.,             | E.M.,   | Lonaconing, Md.      |
| Paul Beno Straub,              | E.E.,   | Pittsburg.           |
| Thomas Cedwyn Thomas,          | E.M.,   | Wilkes-Barre.        |
| Columbus William Thorn,        | C.E.,   | Washington, D.C.     |

|                           | COURSE. | RESIDENCE.        |
|---------------------------|---------|-------------------|
| Wallace Treichler,        | C.E.,   | Elizabethtown.    |
| William Edward Underwood, | M.E.,   | Philadelphia.     |
| Harrison Ricord VanDuyne, | E.E.,   | Newark, N. J.     |
| Charles Parker Wagoner,   | C.E.,   | Phoenixville.     |
| Gilbert Case White,       | C.E.,   | Richmond, Va.     |
| George Livingston Yates,  | E.E.,   | Carlisle.         |
| Ambrose Everett Yohn,     | M.E.,   | Saxton.           |
| Frank Steinmetz Young,    | E.M.,   | Plymouth Meeting. |

## JUNIOR CLASS.

|                              | COURSE. | RESIDENCE.         |
|------------------------------|---------|--------------------|
| Harry Leigh Adams,           | C.E.,   | Washington, D. C.  |
| Thomas Johns Anderson,       | C.E.,   | Cumberland, Md.    |
| Alanson Quigley Bailey,      | Clas.,  | Paterson, N. J.    |
| Junius Ballard,              | M.E.,   | Louisburg, N. C.   |
| Alejandro Barrientos,        | C.E.,   | Santiago de Cuba.  |
| Henry David Bishop,          | M.E.,   | Bethlehem.         |
| Henry Theodore Borhek,       | E.M.,   | Bethlehem.         |
| Daniel John Broughal,        | A. C.,  | South Bethlehem.   |
| Horatio Francis Brown,       | M.E.,   | Baltimore, Md.     |
| Paul Bucher,                 | E.E.,   | Lebanon.           |
| David F. Castilla,           | M.E.,   | Coahuila, Mex.     |
| David Hope Childs,           | E.M.,   | Towanda.           |
| Herbert Myron Daggett,       | E.E.,   | Elmira, N. Y.      |
| George Davies,               | M.E.,   | Catasauqua.        |
| William Adam Dehm,           | C.E.,   | New Britain, Conn. |
| John Jacob Eckfeldt,         | M.E.,   | Conshohocken.      |
| Linden Erle Edgar,           | M.E.,   | Wilkes-Barre.      |
| Edgar Davis Edmonston,       | E.E.,   | Washington, D. C.  |
| James Ralph Farwell,         | C.E.,   | Oswego, N. Y.      |
| Edgar Raymond Frisby,        | C.E.,   | Washington, D. C.  |
| Willard Boyer Fuller,        | M.E.,   | Catasauqua.        |
| José Maria Garza Galán, jr., | E.M.,   | Saltillo, Mex.     |
| Stuart John Gass,            | E.E.,   | Washington, D. C.  |
| Robert Edward Lee George,    | E.E.,   | Ellicott City, Md. |
| William Gratz,               | E.E.,   | Carmel, N. J.      |

|                            | COURSE. | RESIDENCE.           |
|----------------------------|---------|----------------------|
| William Gummere,           | A.C.,   | South Bethlehem.     |
| Frank Hammond Gunsolus,    | C.E.,   | Tipton, Iowa.        |
| Wentworth Greene Hare,     | M.E.,   | Philadelphia.        |
| Raymond Hazel,             | E.E.,   | Cressona.            |
| Henry Bruner Hershey,      | E.E.,   | Columbia.            |
| Herbert Henninger Hess,    | E.E.,   | Hellertown.          |
| Edward Darling Hillman,    | M.E.,   | Wilkes-Barre.        |
| Harold John Horn,          | E.E.,   | South Bethlehem.     |
| Leonard Sherman Horner,    | E.E.,   | Marshall, Va.        |
| Duncan Kennedy, jr.,       | E.E.,   | Washington, D.C.     |
| Frank Norman Kneas,        | C.E.,   | Norristown.          |
| Arthur Octavius Knight,    | M.E.,   | Westfield, N.J.      |
| Basil George Kodjbanoff,   | M.E.,   | Monastir, Macedonia. |
| Jacob B. Krause,           | Clas.,  | South Bethlehem.     |
| Thomas H. Lawrence,        | E.E.,   | Danville.            |
| John Brown Lindsey, jr.,   | C.E.,   | Frankfort, Ky.       |
| Clarence Albert Loomis,    | C.E.,   | Plainfield, N.J.     |
| Owen Francis Luckenbach,   | M.E.,   | Bethlehem.           |
| George Kennedy McGunnege,  | A.C.,   | Meadville.           |
| Lee Holmes Marshall,       | M.E.,   | Pittsburg.           |
| Sidney Burbank Merrill,    | A.C.,   | Cincinnati, O.       |
| Charles Francis Moritz,    | E.E.,   | South Bethlehem.     |
| Charles G. Newton,         | C.E.,   | Guadalajara, Mex.    |
| José Aristides de Obaldia, | C.E.,   | Panama, Rep. Col.    |
| John O'Reilly,             | A.C.,   | South Bethlehem.     |
| Howard Charles Paddock,    | C.E.,   | East Berlin, Conn.   |
| Frederick Allen Perley,    | C.E.,   | Williamsport.        |
| Clarence Marion Pflueger,  | A.C.,   | Seidersville.        |
| Carroll Winston Quarrier,  | M.E.,   | Charleston, W. Va.   |
| Victor Clinton Records,    | C.E.,   | Laurel, Del.         |
| Percy Lawrence Reed,       | C.E.,   | New Bedford, Mass.   |
| Benjamin DeWitt Riegel,    | M.E.,   | Riegelsville, N. J.  |
| D'Arcy Wentworth Roper,    | M.E.,   | Petersburg, Va.      |
| Rafael Francisco Sanchez,  | E.M.,   | Gibara, Cuba.        |
| Henry Cord Schwecke,       | E.E.,   | Charleston, S.C.     |
| Henry Harger Scovil,       | M.E.,   | Copenhagen, N. Y.    |
| Daniel Franklin B. Shepp,  | C.E.,   | Tamaqua.             |
| Lewis Cheston Starkey,     | M.E.,   | Bustleton.           |

|                               | COURSE. | RESIDENCE.       |
|-------------------------------|---------|------------------|
| James Willis Stauffer,        | C.E.,   | South Bethlehem. |
| Martin Shaaft Stockett,       | Clas.,  | Pottsville.      |
| Edmund Harrison Symington,    | M.E.,   | Baltimore, Md.   |
| William Ulrich, jr.,          | A.C.,   | Bethlehem.       |
| Charles Bartlett Warren,      | M.E.,   | Westfield, Mass. |
| Levi Watts, jr.,              | E.E.,   | Terre Hill.      |
| Charles Edward Webster, jr.,  | Clas.,  | South Bethlehem. |
| Frederick Charles Wettlaufer, | A.C.,   | New York City.   |
| Theodore Benjamin Wood,       | M.E.,   | Chambersburg.    |
| William Bell Wood,            | M.E.,   | Baltimore, Md.   |
| Lawrence Wooden,              | C.E.,   | Hampstead, Md.   |
| Warren Worthington,           | M.E.,   | Rushland.        |
| Samuel Augustus Yorks, jr.,   | E.E.,   | Danville.        |
| Harry Statten Zimmerman,      | C.E.,   | State Line.      |

## SOPHOMORE CLASS.

|                            | COURSE. | RESIDENCE.              |
|----------------------------|---------|-------------------------|
| G. Fred Allen,             | C.E.,   | Florida, N. Y.          |
| Leon Whetstone Bailey,     | E.E.,   | Delano.                 |
| Richard Charles Becerra,   | A.C.,   | Caracas, Venezuela.     |
| Maurice Clark Benedict,    | M.E.,   | Altoona.                |
| Arthur Knode Birch,        | E.E.,   | Washington, D.C.        |
| Frank Elliott Bradenbaugh, | M.E.,   | Parkersburg, W. Va.     |
| John Morgan Buckland,      | Sci.,   | Hokendauqua.            |
| José Fernando Capriles,    | C.E.,   | Puerto Cabello, Vene-   |
| Charles Ford Carman,       | C.E.,   | Cedarville, N.J.[zuela. |
| Bernard Todd Converse,     | M.E.,   | Louisville, Ky.         |
| John Peter Croll,          | C.E.,   | Trexlerstown.           |
| Rudolph Degener,           | M.E.,   | New York City.          |
| Joseph K. Ellenbogen,      | L.S.,   | Allentown.              |
| James Chickering England,  | E.E.,   | Washington, N.J.        |
| Robert Farnham, jr.,       | C.E.,   | Washington, D.C.        |
| José Gervasio Gandia,      | C.E.,   | Puerta de Tierra, Por-  |
|                            |         | to Rico.                |
| J. Walter Gannon,          | C.E.,   | New Brighton, S.I.      |
| James Henry Gledhill,      | M.E.,   | Riegelsville.           |

|                              | COURSE. | RESIDENCE.                         |
|------------------------------|---------|------------------------------------|
| Eugene Gifford Grace,        | E. E.,  | Goshen, N. J.                      |
| John Wesley Grace, jr.,      | E. E.,  | Goshen, N. J.                      |
| Oscar Cooper Hannum,         | C. E.,  | Philadelphia.                      |
| George Duncan Heisey,        | E. M.,  | Pittsburg.                         |
| Paul Gerhard Ludiger Hilken, | M. E.,  | Baltimore, Md.                     |
| James Cuthbert Holderness,   | E. E.,  | Cambridge, Mass.                   |
| George Augustus Horne,       | A. C.,  | Plainfield, N. J.                  |
| Roy Rhodes Hornor,           | E. M.,  | Clarksburg, W. Va.                 |
| George Reifsnyder Jackson,   | C. E.,  | Seranton.                          |
| Harry Reese James,           | M. E.,  | Braddock.                          |
| Edward Allen Keys,           | C. E.,  | Linden, Md.                        |
| Russell Kimball,             | M. E.,  | New York City.                     |
| Arthur Warner Klein,         | M. E.,  | Bethlehem.                         |
| Clark Miles Knight,          | M. E.,  | Bethlehem.                         |
| Harry Edward Knight,         | Sci.,   | New York City.                     |
| Richard Skerrett Landron,    | C. E.,  | Puerta de Tierra, Por-<br>to Rico. |
| George Craig Leidy,          | C. E.,  | Washington, D. C.                  |
| Newton Wambold Leidy,        | E. E.,  | West Bethlehem.                    |
| Garth Bainbridge Luten,      | C. E.,  | Cayce, Ky.                         |
| Charles Michael Masson,      | M. E.,  | Rheims, N. Y.                      |
| William Lathrop Meaker,      | A. C.,  | South Bethlehem.                   |
| James Flanders Middledith,   | M. E.,  | Plainfield, N. J.                  |
| Robert Hopkins Moffitt, jr., | E. M.,  | Harrisburg.                        |
| J. Foster Morgan,            | E. E.,  | Harwood Mines.                     |
| Charles Souders Padget,      | Arch.,  | Bethlehem.                         |
| Henry Ralph Palmer,          | M. E.,  | West Chester.                      |
| John Read Pettit,            | E. M.,  | Philadelphia.                      |
| William Piez,                | M. E.,  | New York City.                     |
| Louis Thomas Rainey,         | E. E.,  | Decatur, Ill.                      |
| James Burr Reddig,           | M. E.,  | Shippensburg.                      |
| Percy Lesley Reed,           | C. E.,  | Altoona.                           |
| Victor Hugo Reid,            | C. E.,  | Brooklyn, N. Y.                    |
| Howard Albert Riegel,        | C. E.,  | Bethlehem.                         |
| George Loomis Robinson,      | C. E.,  | Elmira, N. Y.                      |
| Gustavo Rovelo,              | M. E.,  | Comitan-Chiapas, Mex               |
| Oliverio Sanchez,            | C. E.,  | Nuevitas, Cuba.                    |
| Abraham Shimer,              | M. E.,  | West Bethlehem.                    |

|                           | COURSE. | RESIDENCE.          |
|---------------------------|---------|---------------------|
| Robert Sargent Shriver,   | Arch.,  | Cumberland, Md.     |
| William Harold Speirs,    | E.E.,   | St. Louis, Mo.      |
| Abram Peters Steckel,     | E.E.,   | Lykens.             |
| Robert Maximilian Straub, | C.E.,   | Pittsburg.          |
| William Wharton Thurston, | E.M.,   | South Bethlehem.    |
| Laurens Van Benthem,      | E.E.,   | The Hague, Holland. |
| John Sage Viehe,          | E.E.,   | Vincennes, Ind.     |
| Theodore Cuyler Visscher, | C.E.,   | Rome, N.Y.          |
| Joseph D. Wentling,       | C.E.,   | Greensburg.         |
| David Sheibley Wert,      | E.E.,   | Carlisle.           |
| Harry Anderson Wilcox,    | C.E.,   | West Granby, Conn.  |
| George Bassett Williams,  | Arch.,  | Washington, D.C.    |
| George Herbert Wood,      | M.E.,   | Chambersburg.       |
| Wright Youtsey,           | E.M.,   | Newport, Ky.        |

## FRESHMAN CLASS.

|                            | COURSE. | RESIDENCE.         |
|----------------------------|---------|--------------------|
| Louis Benjamin Abbott,     | M.E.,   | Carbondale.        |
| Raymond Claud Albright,    | E.E.,   | Allentown.         |
| George Kriebel Anders,     | E.E.,   | Lansdale.          |
| Arthur Benjamin Anderson,  | E.E.,   | Philadelphia.      |
| George William Barager,    | M.E.,   | Hazleton.          |
| Paul Weiss Barber,         | M.E.,   | Bethlehem.         |
| Wallace Edgar Bartholomew, | C.E.,   | Richlandtown.      |
| Albert William Bayard,     | M.E.,   | Washington, D.C.   |
| Berthold Graeff Beck,      | E.E.,   | West Bethlehem.    |
| Thomas Francis Bell,       | M.E.,   | Shenandoah.        |
| John Francis Benson,       | C.E.,   | Portsmouth, Va.    |
| Edwin Percy Bigelow,       | E.E.,   | Oxford, N.J.       |
| Marmion Stanley Black,     | A.C.,   | Swedesboro, N.J.   |
| James Raymond Boak,        | E.E.,   | Hughesville.       |
| Russell Julian Borhek,     | M.E.,   | West Bethlehem.    |
| Reginald Welles Bours,     | C.E.,   | Jacksonville, Fla. |
| John Hall Bower,           | E.M.,   | Myerstown.         |
| Henry Lawton Bowers,       | A.C.,   | Rome, N.Y.         |
| Andrew Thomas Brice,       | E.E.,   | New York City.     |

|                             | COURSE. | RESIDENCE.           |
|-----------------------------|---------|----------------------|
| John James Brice,           | C. E.,  | New York City.       |
| Joseph William Burke,       | C. E.,  | Shenandoah.          |
| Marshall Greene Candee,     | E. E.,  | Washington, D. C.    |
| David Hastings Canfield,    | Arch.,  | Middletown, N. Y.    |
| Morrow Chamberlain,         | E. M.,  | Chattanooga, Tenn.   |
| Hugh Banks Chapman,         | E. E.,  | St. Elmo, Tenn.      |
| George Ralph Coffin,        | A. C.,  | Bradford.            |
| Richard Cromwell Congdon,   | M. E.,  | Baltimore, Md.       |
| Robert Milton Cortright,    | E. E.,  | Bethlehem.           |
| George Curtis Coutant,      | E. E.,  | High Falls, N. Y.    |
| George Hooper Day,          | E. E.,  | Batavia, N. Y.       |
| John Kenelm Digby,          | E. M.,  | London, England.     |
| Herbert C. Dilliard,        | E. E.,  | East Bangor.         |
| Raymond Aloysius Dinan,     | A. C.,  | South Bethlehem.     |
| Alan Craig Dodson,          | L. S.,  | Bethlehem.           |
| Truman Monroe Dodson, 2d,   | E. M.,  | Bethlehem.           |
| Gavin Hogg Dortch,          | M. E.,  | Goldsboro, N. C.     |
| William T. Drake,           | M. E.,  | Old Forge.           |
| Nimson Eckert,              | Clas.,  | Allentown.           |
| Charles Albion Emerson,     | E. E.,  | Summerville, S. C.   |
| John William Fletcher,      | M. E.,  | Skowhegan, Me.       |
| Theodore Frederic Forbes,   | A. C.,  | Fort McPherson, Ga.  |
| Donald Calvert Fugitt,      | M. E.,  | Washington, D. C.    |
| John Fuller,                | M. E.,  | Quarryville, N. J.   |
| Frank Giering,              | M. E.,  | Bethlehem.           |
| Author Hendrix Gill,        | E. E.,  | Boring, Md.          |
| George C. D. Goldsmith,     | C. E.,  | Catasauqua.          |
| Herbert Terry Greene,       | E. M.,  | Montclair, N. J.     |
| Frederick Augustus Groff,   | E. E.,  | Rome, N. Y.          |
| Charles Frederick Gross,    | C. E.,  | Belvidere, N. J.     |
| William B. Grubbe,          | C. E.,  | Pine Plains, N. Y.   |
| Arthur Bradley Hanscom,     | C. E.,  | Philadelphia.        |
| Edmund Franklin Harmony,    | A. C.,  | Allentown.           |
| Ernest Warfel Haverstick,   | E. E.,  | Lancaster.           |
| Austin Diehl Heller,        | L. S.,  | Hellertown.          |
| Albert Darby Hollingsworth, | Arch.,  | Scotch Plains, N. J. |
| Michael James Honan,        | E. E.,  | Oxford, N. J.        |
| Edward Melville Huggins,    | E. E.,  | Nevis, British W. I. |

|                             | COURSE. | RESIDENCE.            |
|-----------------------------|---------|-----------------------|
| Lloyd Jones Iredell,        | Sci.,   | Allentown.            |
| Clarence Peter Kennedy,     | Sci.,   | Buffalo, N.Y.         |
| Elliott Bosworth Kitchell,  | E.E.,   | South Orange, N.J.    |
| Paul Kline,                 | C.E.,   | Pittsburg.            |
| Frank Jones Laubenstein,    | Sci.,   | Ashland.              |
| Mason Benedict Lawton,      | A.C.,   | Rome, N.Y.            |
| John Edward Leibfried,      | A.C.,   | Bethlehem.            |
| William Grant Lessig,       | E.E.,   | Shenandoah.           |
| Herbert Spencer Lewis,      | C.E.,   | Baltimore, Md.        |
| Thomas Windle Lukens,       | E.M.,   | Atglen.               |
| Charles Edward Terry Lull,  | E.M.,   | Trenton, N.J.         |
| William Thomas McCarthy,    | Arch.,  | Rome, N.Y.            |
| Kenneth Wesley McComas,     | A.C.,   | South Bethlehem.      |
| David Graham McGavock,      | E.E.,   | Graham's Forge, Va.   |
| Johnson McVeigh,            | A.C.,   | New York City.        |
| William George McVeigh,     | C.E.,   | New York City.        |
| Carl Edward Maeder,         | M.E.,   | Pittsburg.            |
| Harry Ivins Magee,          | C.E.,   | Philadelphia.         |
| William Elston Magie,       | M.E.,   | New York City.        |
| Joseph Patrick Martin,      | C.E.,   | Plymouth.             |
| J. Louis Meixell,           | E.E.,   | Parsons, Kan.         |
| Harry Maxwell Menner.       | A.C.,   | Bethlehem.            |
| Manuel de la Mora,          | C.E.,   | Guadalajara, Mex.     |
| Robert C. Morris, jr.,      | M.E.,   | Pottsville.           |
| George Rohrer Morrow,       | A.C.,   | Highspire.            |
| Harry Tilghman Ochs,        | E.E.,   | Allentown.            |
| Louis Ortnier,              | M.E.,   | Drifton.              |
| Arthur Rose Parsons,        | E.M.,   | Salt Lake City, Utah. |
| Frederick Jay Payne,        | M.E.,   | Copenhagen, N.Y.      |
| John Hazelrod Pomeroy,      | E.E.,   | Ridley Park.          |
| Norman S. Powell,           | E.M.,   | West Middlesex.       |
| Joseph Jacob Reamer,        | C.E.,   | Waterloo, N.Y.        |
| John Nicholas Reese,        | E.E.,   | Harrisburg.           |
| Alexander Duffield Robb,    | A.C.,   | Phoenixville.         |
| Walter Henry Rodney,        | C.E.,   | Baltimore, Md.        |
| Ferdinand W. Roebling, jr., | M.E.,   | Trenton, N.J.         |
| James George Ross,          | C.E.,   | Kittanning.           |
| Charles Edward Rowe,        | M.E.,   | Philadelphia.         |

|                             | COURSE. | RESIDENCE.                     |
|-----------------------------|---------|--------------------------------|
| Armando Sanchez,            | E.M.,   | Nuevitas, Cuba.                |
| Alfredo J. Sanchez,         | A.C.,   | Matanzas, Cuba.                |
| Edmund Trowbridge Satchell, | A.C.,   | Lancaster.                     |
| Martin Schwerin,            | E.M.,   | New York City.                 |
| Carlos Nathaniel Scovil,    | M.E.,   | Copenhagen, N. Y.              |
| Harvey Simon Seiple,        | M.E.,   | Bethlehem.                     |
| Joseph Stauffer Shultz,     | C.E.,   | Washington Boro.               |
| Clayton Miller Simmers,     | C.E.,   | Phoenixville.                  |
| Charles Sylvanus Snyder,    | A.C.,   | South Bethlehem.               |
| Arturo Solórzano,           | M.E.,   | Managua, Nicaragua.            |
| William Paul Starkey,       | M.E.,   | Bustleton.                     |
| Herbert Spencer Stauffer,   | M.E.,   | South Bethlehem.               |
| John Alvin Strauss,         | E.E.,   | Sayre.                         |
| Henry A. Tobelmann, jr.,    | A.C.,   | Newark, N.J.                   |
| Arthur W. T. Turner,        | M.E.,   | Amherst, Mass.                 |
| John Ralph VanDuyne,        | C.E.,   | Newark, N.J.                   |
| Bertil Von Philp,           | M.E.,   | West Bethlehem.                |
| Richard Ambrose Warner,     | E.M.,   | Washington, D.C.               |
| William Penn White,         | E.E.,   | Washington, D.C.               |
| William Townsend White,     | Arch.,  | Williamsport.                  |
| Lloyd Wilcoxon,             | M.E.,   | Freeport, Ill.                 |
| Toros Kurk Yasharian,       | E.E.,   | Hedjin, Asia Minor,<br>Turkey. |
| Edward Robins Zalinski,     | E.M.,   | Medina, N.Y.                   |

## SPECIAL STUDENTS.

|                            | COURSE. | RESIDENCE.        |
|----------------------------|---------|-------------------|
| Thomas Micks Clinton,      | E.E.,   | Baltimore, Md.    |
| George Duncan Heisey,      | E.M.,   | Pittsburg.        |
| Francis Betts Smith,       | M.E.,   | Hartford, Conn.   |
| Brigham Smoot,             | A.C.,   | Provo City, Utah. |
| Harry Wellington Thatcher, | A.C.,   | South Bethlehem.  |



|                       |   |   |   |   |   |   |   |   |   |   |       |
|-----------------------|---|---|---|---|---|---|---|---|---|---|-------|
| Porto Rico,           | - | - | - | - | - | - | - | - | - | - | 2     |
| British West Indies,  | - | - | - | - | - | - | - | - | - | - | 1     |
| Nicaragua,            | - | - | - | - | - | - | - | - | - | - | 1     |
| Republic of Colombia, | - | - | - | - | - | - | - | - | - | - | 1     |
| Venezuela,            | - | - | - | - | - | - | - | - | - | - | 2     |
| England,              | - | - | - | - | - | - | - | - | - | - | 1     |
| Holland,              | - | - | - | - | - | - | - | - | - | - | 1     |
| Macedonia,            | - | - | - | - | - | - | - | - | - | - | 1     |
| Turkey,               | - | - | - | - | - | - | - | - | - | - | 1     |
|                       |   |   |   |   |   |   |   |   |   |   | <hr/> |
|                       |   |   |   |   |   |   |   |   |   |   | 365   |

# SUMMARY OF STUDENTS BY CLASSES AND COURSES.

|                      | GRADUATES. | SENIORS. | JUNIORS. | SOPHOMORES. | FRESHMEN. | SPECIALS. | TOTALS. |
|----------------------|------------|----------|----------|-------------|-----------|-----------|---------|
| Classical,           | 7          | —        | 4        | —           | 1         | —         | 12      |
| Latin-Scientific,    | —          | —        | —        | 1           | 2         | —         | 3       |
| Science and Letters, | 1          | —        | —        | 2           | 3         | —         | 6       |
| Civil Engineering,   | 1          | 20       | 20       | 22          | 21        | —         | 84      |
| Mechanical Eng.,     | 3          | 22       | 24       | 18          | 28        | 1         | 96      |
| Mining Eng.,         | 3          | 10       | 4        | 6           | 13        | 1         | 37      |
| Electrical Eng.,     | 1          | 23       | 17       | 14          | 29        | 1         | 85      |
| Analytical Chem.,    | 2          | 3        | 8        | 3           | 16        | 2         | 34      |
| Architecture,        | —          | —        | —        | 3           | 5         | —         | 8       |
| Totals,              | 18         | 78       | 77       | 69          | 118       | 5         | 365     |

ALUMNI  
OF THE  
LEHIGH UNIVERSITY.

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## CLASS OF 1869.

\*J. Haynes Hinds Corbin, A.C.

Charles Edward Ronaldson, M.E., The Geo. V. Cresson Co., Room 214, 136 Liberty Street, New York City.  
Residence: Zeta Psi Club, 148 W. 34th St.

Miles Rock, C.E., Astronomer, Chief Engineer, and President of the Boundary Commission of Guatemala with Mexico, Guatemala City, Central America.

## CLASS OF 1870.

\*Lehman Preston Ashmead, A.C., M.D.

Richard Brodhead, M.E., Attorney-at-Law, 32 Nassau Street, New York City.

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George A. Jenkins, A.C., Bethlehem Iron Co., South Bethlehem, Pa.

William J. Kerr, A.C., M.E., Supt. Motive Power, Union Traction Co., Ninth and Dauphin Sts., Philadelphia, Pa. Residence: 1010 South 49th St.

\*Harry E. Packer, A.C.

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\*William Dunlop Ronaldson, B.A., M.D.

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\*Russel B. Yates, C.E.

\*Deceased.

## CLASS OF 1871.

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\*Charles G. Weaver, C.E.

## CLASS OF 1872.

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Henry St. Leger Coppée, C.E., U. S. Assistant Engineer, Greenville, Miss.

\*F. R. Christian Degenhart, A.C.

Harvey S. Houskeeper, B.A., Principal of State Academy, Brookeville, Md.

\*Lentz Edmund Klotz, C.E.

Oscar Moore Lance, A.C., Asst. General Manager, Spring Brook Water Supply Co., Wilkes-Barre, Pa. Residence: Plymouth, Pa.

Raymundo Floresta de Miranda, C.E., Division Engineer, Rio de Janeiro and Northern R. R. Address: E. F. Principe de Grao Pará, Estação Areal, Rio de Janeiro, Brazil.

\*Deceased.

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## CLASS OF 1873.

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James Peyton Stuart Lawrance, M.E., Chief Engineer U.S. Navy, Inspector of Machinery for U.S. Navy, Newport News Shipbuilding and Dry Dock Co., Newport News, Va. Permanent address : care of Navy Department, Washington, D.C.

Hildebrando Barjona de Miranda, A.C., Professor of English, Lyceo Paraence, Belém do Pará, Estados Unidos do Brazil.

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## CLASS OF 1874.

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William Marshall Rees, C.E., First Assistant Engineer, Mississippi River Improvement, Appeal Building, Memphis, Tenn.

## CLASS OF 1875.

Charles Julius Bechdolt, C.E., Superintendent Central Division P., W. & B. R. R., Media, Pa.

Antonio M. Cañadas, A.C., Chemist, Loja, Ecuador.

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\*Carl F. Zogbaum, C.E.

## CLASS OF 1876.

Frank C. Angle, C.E., Attorney-at-Law, Danville, Montour Co., Pa.

\*James DeWitt Carson, C.E.

\*Thomas William Frederick, M.E.

William Griffith, C.E., Mining Engineer and Coal Specialist, Coal Exchange, Scranton, Pa. Residence: 405 Susquehanna Ave., West Pittston, Pa.

C. William Macfarlane, C.E., Ph.D. (Freiberg i. B. '93).

Robert W. Mahon, C.E., Ph.D. (Johns Hopkins), Monongahela Furnace Co., McKeesport, Pa.

J. J. de Gama Malcher, M.E.

Walter Percival Rice, C.E., Civil Engineer, The Walter P. Rice Engineering Company, 545 Society for Savings Building, Cleveland, Ohio. Residence: 293 Euclid Ave.

\*Deceased.

Henry Richards, E.M., Contractor, Dover, N.J.

Lowdon W. Richards, M.E., Columbia, Pa.

Charles L. Taylor, E.M., Assistant Secretary The Carnegie Co., Limited, 48 Fifth Ave., Pittsburg, Pa.

CLASS OF 1877.

John Eagley, C.E., North Springfield, Erie Co., Pa.

Percival D. Giess, C.E., Bethlehem, Pa.

Andrew M. Glassel, C.E., Bowling Green, Va.

George M. Heller, C.E., Bridge Engineer, 853 North 20th Street, Philadelphia, Pa.

Henry Sylvester Jacoby, C.E., Associate Professor of Civil Engineering, in charge of Bridge Engineering and Graphics, Cornell University. Residence: 7 Reservoir Avenue, Ithaca, N.Y.

James Fremont Marsteller, C.E., Superintendent, Snow Shoe Division, Lehigh Valley Coal Co., Snow Shoe, Centre Co., Pa.

\*Seizo Miyahara, C.E.

Charles R. Rauch, A.C., Central Hotel, Bethlehem, Pa.

Lewis Theodore Wolle, C.E., Secretary of the Cambria Mining Co., Cambria, Weston Co., Wyoming.

CLASS OF 1878.

Charles Bull, M.E., Assistant Librarian and Bursar, General Theological Seminary, Chelsea Square, New York City.

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Frank Perley Howe, B.A. (Brown), E.M., President, The North Branch Steel Co.; Vice-President, Wm. Wharton, jr., & Co., Inc. Residence: 251 South 17th Street, Philadelphia, Pa.

\* Deceased.

Nathaniel Lafon, M.E., Engineer for Bird Eye-Jellico Coal Co., Halsey, Whitley Co., Ky.

Benjamin B. Nostrand, jr., M.E., Electrical Engineer, The Westinghouse Electric and Manufacturing Co.; Treasurer and Manager, The Sing Sing Electric Lighting Co.; President and Treasurer, The Peekskill Electric Light and Power Co., Peekskill, N. Y.

Milnor Peck Paret, C.E., Resident Engineer, Kansas City Terminal Construction Company, Lake Charles, La.

Holbrook Fitz John Porter, M.E., General Western Sales Agent for the Bethlehem Iron Co., Room 1433 Marquette Building, Chicago, Ill. Residence: 4214 Berkeley Avenue.

William K. Randolph, C.E.

Robert H. Read, B.A., Counsellor and Expert in Patent Causes, 44 Broad Street, New York City.

Henry Church Wilson, C.E., Chief Clerk, U. S. Engineer Office, Telephone Building, Galveston, Texas.

#### CLASS OF 1879.

James S. Cunningham, M.E., Chief Engineer, Berwind-White Coal Mining Co., Tyrone, Pa.

\*Joseph Hill Paddock, M.E.

Fitz William Sargent, C.E., General Agent The Sargent Co., 675 Old Colony Building, Chicago, Ill. Residence: The Irving, 308 N. State Street.

Richard Hawley Tucker, C.E., Astronomer, Lick Observatory, Mt. Hamilton, Cal.

#### CLASS OF 1880.

Abraham Bruner, E.M., Civil Engineer, Assistant Engineer, Norfolk & Western R.R., Crewe, Nottoway Co., Va.

Murray Morris Duncan, A.C., E.M. ('80), General Manager Antrim Iron Company, Mancelona, Mich.

\*Deceased.

Thomas Hughlett Hardcastle, B.A., M.A. ('82), LL.B.,  
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Residence: 1042 Pearl Street.

John Tinsley Jeter, E.M., Superintendent of the Key-  
stone Coal Co., Wilkes-Barre, Pa. Residence: 222 S.  
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Charles Francis King, A.C.

George Ernest Potter, C.E., Assistant Engineer, New  
York, Chicago & St. Louis R. R., 151 Wayne Street,  
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Frederick Putnam Spalding, C.E., Assistant Professor  
of Civil Engineering, Cornell University, Ithaca, N. Y.  
Residence: 159 E. Seneca St.

Leonard Blakeslee Treharne, B.A., Editorial Depart-  
ment, *New York Times*, New York City.

Benjamin Russell Van Kirk, M.E., Locomotive Designer,  
Baldwin Locomotive Works, 2105 Green Street, Phila-  
delphia, Pa.

\*Frederick Copeland Wooten, M.E.

#### CLASS OF 1881.

William Simon Crazz, A.C.

Alexander Patrick Crilly, B.A., Allentown, Pa.

Thomas Morgan Eynon, M.E., General Manager, The  
Eynon-Evans Mfg. Co., 15th and Clearfield Streets,  
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Charles Weed Gray, A.C.

Benjamin Franklin Haldeman, E.M., Superintendent,  
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town, Pa. Residence: Fayette Street, Westmont,  
Johnstown.

Lewis Stockton, B.A., Counselor-at-Law, Erie Bank  
Building, Cor. Niagara and Main Streets, Buffalo, N. Y.  
Residence: Cor. North and Franklin Streets.

#### CLASS OF 1882.

Louis Oscar Emmerich, E.M., Mining Engineer, Hazle-  
ton, Pa.

\*Deceased.

Charles Comstock Hopkins, B.S. (Sci.), C.E. ('84), member of firm of The Stanwix Engineering Co., Hydraulic and Sanitary Engineers, Rome, N.Y.

Elmer Henry Lawall, C.E., General Superintendent Lehigh & Wilkes-Barre Coal Co., Wilkes-Barre, Pa. Residence: 133 S. Franklin St.

Robert Thomas Morrow, C.E., Assistant Engineer, Elmira and Canandaigua Divisions, N. C. Ry., Elmira, N. Y. Residence: 702 Park Place.

Eugene Ricksecker, C.E., Civil Engineer, and U.S. Assistant Engineer in local charge of fortifications and defences of Puget Sound, 602 Burke Building, Seattle, Washington. Address: P. O. Box 289.

John Dougherty Ruff, E.M., 328 South 21st Street, Philadelphia, Pa.

\*Samuel Brenton Sickler, C.E.

Martin Wittmer, E.M., Superintendent Wittmer Brick Co., Limited, Glen Shaw, Allegheny Co., Pa.

#### CLASS OF 1883.

\*Enos Kellar Bachman, E.M.

Walter Briggs, B.A., Attorney-at-Law, Commonwealth Building, Scranton, Pa. Residence: 1505 Adams Ave.

Henry Augustus Butler, B.S. (Sci.), Secretary and Treasurer, Carbon Iron and Steel Co., Limited, Mauch Chunk, Pa.

Hedley Vicars Cooke, B.A., LL.M. (Columbian University), Attorney-at-Law, Union Trust Building, 707 Olive St., St. Louis, Mo. Residence: Normandy, Mo.

Francis Joseph Crilly, B.A., M.A. ('89), Special Deputy Collector of the Port, Customs House, Philadelphia. Residence: 1926 Spring Garden Street.

Francis Wharton Dalrymple, C.E., City Engineer, 131 Main Street, Hornellsville, N.Y.

Timothy James Donahoe, A.C., Benson Mines, N. Y.

George Francis Duck, E.M., Consulting Mining Engineer, P. O. Box 825, Pittsburg, Pa.

\*Deceased.

- Alfred Edmond Forstall, M.E., Assistant Superintendent,  
The Newark Gas Co., Jersey Street Gas Works, Newark,  
N.J. Residence: 63 Orchard St.
- Nathaniel Oliver Goldsmith, M.E., Principal Engineer,  
The Weir Frog Co., Cincinnati, Ohio. Residence: 21  
Somerset Building, Avondale.
- William Theodore Goodnow, C.E., General Manager  
Cayuta Wheel and Foundry Co., and The Sayre Land  
and Water Co., Sayre, Pa.
- John Daniel Hoffman, B.A., M.A. ('89), Counselor-at-  
Law, 17 Broad Street, Bethlehem, Pa. Residence:  
30 N. Main Street.
- George Gowen Hood, C.E., Civil Engineer, Mount Airy,  
Philadelphia, Pa.
- Garrett Linderman Hoppes, C.E., Eagle Hotel, Bethlehem,  
Pa.
- Julian de Bruyn Kops, jr., B.E. (University of Georgia),  
C.E., Assistant City Engineer, Savannah, Ga.
- Preston Albert Lambert, B.A., M.A. ('91), Instructor in  
Mathematics, Lehigh University, South Bethlehem, Pa.
- Edwin Francis Miller, M.E., with R. D. Wood & Co.,  
Camden, N.J.
- Rev. Wilson Franklin More, B.A., M.A. ('91), Pastor  
Salem Reformed Church, Catasauqua, Pa.
- Nelson Morrow, M.E., Manager of the Deep Rock Mineral  
Springs, Oswego, N.Y. Residence: 235 W. First St.
- Thomas Nicholson, M.E., with the Johnstown R.R. Frog  
and Switch Co., Chester, Pa.
- George Spencer Patterson, E.M., Mining and Civil Engi-  
neer, Box 181, Terre Haute, Ind. Residence: 710 Ohio  
Street.
- Rembrandt Richard Peale, B.S. (Sci.), Secretary and  
Treasurer, Bloomington Mining Co., 411-413 Walnut  
Street, Philadelphia, Pa.
- Henry Allebach Porterfield, E.M., President and Gen-  
eral Manager, The Dexter Spring and Gear Co., Inc.,  
Pittsburg, Pa. Residence: 319 S. Hiland Avenue,  
E.E.

- Francis Henry Purnell, C.E., E.M. ('86), Clerk of the Circuit Court, Worcester Co., Snow Hill, Md.
- Jesse Wilford Reno, E.M., Rapid Transit Tunnel for New York City, The Reno Inclined Elevator Co., Mining Expert, Mills Building, New York City.
- Charles Loomis Rogers, M.E., General Manager, Milton Car Works, Milton, Pa.
- John Ruddle, M.E., General Supervisor, Canal Department, The Lehigh Coal and Navigation Co., Mauch Chunk, Pa.
- Charles Henry Stinson, B.S. (Sci.), Attorney-at-Law, Norristown, Pa.
- \*Robert Stinson, B.S. (Sci.).

## CLASS OF 1884.

- Robert Grier Cooke, B.A., Journalist, with Harper & Brothers, Franklin Square, New York City. Residence: 24 E. 47th St.
- Henry Bowman Douglas, B.M., E.M. ('85), Consulting Mining Engineer, Vinton Colliery Co., Vintondale, Cambria Co., Pa.
- William Banks Foote, B.M., E.M. ('86), Etiwanda, San Bernardino Co., Cal.
- Harry Tallman Harper, C.E., Assistant Engineer, Florence & Cripple Creek Railroad, Florence, Col.
- Harry Hurd Hillegass, C.E., Civil Engineer, Reading, Pa.
- Edwin Franklin Hofford, C.E., Leighton, Pa.
- John Andrew Jardine, B.M., E.M. ('85), Superintendent Mining Department, Watts Steel and Iron Syndicate, Ltd., Middlesboro, Ky. Mailing Address: Kenvil, Morris Co., N.J.
- James Warner Kellogg, M.E., Manager of Isolated and Marine Sales, General Electric Co., Schenectady, N.Y.
- David Garrett Kerr, B.M., Edgar Thomson Steel Works, Wilksburg, Pa.
- Frederick Bowman Langston, C.E., Architect, 1239 Bedford Avenue, Brooklyn, N.Y.
- \*Deceased.

William Langston, C.E., with Dean & Westbrook, Bridge Engineers and Contractors, 136 Liberty St., New York City.

Robert Packer Linderman, Ph.B., President of the Bethlehem Iron Company; President of the Lehigh Valley National Bank. Residence: South Bethlehem, Pa.

Joseph Franklin Merkle, C.E., M.D. (Univ. of Pa., '94), Physician and Surgeon, Llewellyn, Pa.

Harry Krider Myers, C.E., Miner and Shipper of Clearfield Bituminous Coal, Osceola Mills, Clearfield Co., Pa. 3423 North 19th Street, Philadelphia, Pa.

Albino Rosendo Nuncio, M.E., 3d Officer of the Section of Agriculture and Patents of the Secretary of Fomento, City of Mexico, Mexico.

James Ward Packard, M.E., President, The Packard Electric Co., Manufacturers, Warren, O.

Alfred Scull Reeves, B.M., E.M. ('85), of the firm of Paul S. Reeves & Son, Manufacturers of Phosphor Bronze, Brass, Babbitt Metals, etc., 1415-1425 Catharine Street, Philadelphia, Pa. Residence: 21st Street and Delancey Place.

Barry Searle, A.C., Superintendent Deep Crown Gold Mine, Johannesburg, South African Republic. Permanent Address: care of R. S. Searle, Montrose, Pa.

Lewis Buckley Semple, B.A., M.A. ('91), Ph.D. (Princeton), Instructor in English, Lehigh University.

Augustus Parker Smith, M.E., Lawyer; specialty, Patent Litigation and Investigation of Patented Inventions. Office: American Tract Society's Building, 150 Nassau St., New York City. Residence: 126 Prospect Place, Brooklyn.

Murray Stewart, M.E., Motive - Power Department, Philadelphia, Wilmington & Baltimore R. R. Co., Wilmington, Del.

Richard Washington Walker, C.E., Engineer in Guatemalan Commission for Survey of Boundary between Guatemala and Mexico, Guatemala, Centro-America, or Glen Moore, Pa.

James Angus Watson, C.E., Patent Lawyer, 931 F Street, N.W., Washington, D. C. Residence: 1454 Howard Avenue.

## CLASS OF 1885.

Warren Howard Allen, A.C., Clerk, Farmers' National Bank, Athens, Pa.

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William Harvey Cooke, B.A., M.D., 10 N. Munn Avenue, East Orange, N. J.

William Noble Edson, C.E.

\*John Roberts Engelbert, C.E.

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\*Fayette Brown Petersen, C.E.

John Bertsch Price, C.E., Cashier, First National Bank, Hazleton, Pa.

Harry William Rowley, M.E., Chief Draughtsman, The Dickson Manufacturing Co., Scranton, Pa. Residence: 411 Madison Avenue.

\*Elliot Otis Smith, C.E.

Clarence Moncure Tolman, M.E., Engineer, care of Edward G. Stoiber, Silver Lake Mines, Silverton, Col. Address: P. O. Box 129.

\*Deceased.

- John R. Wagner, M.E., Superintendent of Motive Power, Delaware, Susquehanna & Schuylkill R. R.; also Superintendent of Tests of the Coxe Iron Mfg. Co. Residence: Drifton, Luzerne Co., Pa.
- James Hollis Wells, C.E., Civil Engineer, with Clinton & Russel, Architects, 32 Nassau Street, New York City.
- Cabell Whitehead, B. M., M. S. (Columbian Univ.), Assayer, Bureau of the Mint, Treasury Department, Washington, D.C. Residence: 1114 New Hampshire Avenue.

## CLASS OF 1886.

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- William Henry Dean, B.M., E.M. ('86), A.C. ('86), Analytical Chemist, and Professor of Chemistry, Harry Hillman Academy, 89 West River Street, Wilkes-Barre, Pa.
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- Robert Caldwell Gotwald, C.E., Civil Engineer and Architect, Springfield, O.

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## CLASS OF 1887.

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## CLASS OF 1888.

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- Charles Noble Butler, C.E., Attorney-at-Law, Patent, Trade-Mark, and Copyright Cases, 1001 Chestnut St., Philadelphia, Pa.
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- Alfred Eli Lewis, jr., B.S., E.M. ('89), 1510 Chestnut St., Philadelphia, Pa.
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- James Struthers Mack, C.E., Mining Engineer for Hemfield, Greensburg, and Carbon Coal Companies, Greensburg, Pa.
- Charles Donnell Marshall, C.E., Secretary Shiffler Bridge Company, 48th Street and A. V. R. R., Pittsburg, Pa. Residence: 226 Fairmount Ave.
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- George Philips Miller, B.A. and M.A. (Bucknell), C.E., County Clerk and Recorder, Taos, New Mexico.
- John Hoff Millholland, C.E., Attorney-at-Law, 520 Washington Street, Reading, Pa.
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- Daniel Livermore Mott, C.E., Assistant City Engineer, Utica, N.Y.
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## CLASS OF 1889.

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- Adolph Cardenas, C.E., Engineer Corps, Nicaragua  
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- Frank Raymond Coates, B.S., E.M. ('91), Roadmaster,  
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- George Nauman, jr., C.E., with the Pennsylvania R. R. Engineer Corps, Delair, N.J.
- Robert Engler Neumeyer, C.E., Borough Engineer of Bethlehem, Borough Engineer of South Bethlehem, Water Superintendent for the Bethlehem Water Co. Residence: 16 Goepp St., Bethlehem.
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- Charles Platt, A.C., Ph.D. (Ohio University), F.C.S., Consulting Chemist, Professor of Chemistry and Toxicology, Hahnemann Medical College, Philadelphia.
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- Claude Allen Porter Turner, C.E., Chief Draughtsman, Pottsville Iron & Steel Co., Pottsville, Pa.
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## CLASS OF 1891.

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- James Edwin Boatrite, C.E., *World* Building, New York City.
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- Jacob Burr Buckley, E.E., Carpenter and Builder, Oxford,  
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- Emanuel Chao, C.E., Cienfuegos, Cuba.
- Edward Haviland Coxe, C.E., Mining Engineer, Sunday  
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- Warder Cresson, M.E., with Lehigh Valley Railroad  
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- Walton Forstall, E.E., Superintendent, Lockport Gas  
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- Hermann Victor Hesse, B.S., E.M. ('92), Lehigh Valley Coal  
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- Paul Depue Honeyman, E.E., Chief Foreman, in charge Underground and Central Office, The Metropolitan Telephone and Telegraph Co., 18 Cortlandt St., New York City.
- John Turner Hoover, B.S. (in Architecture), Philipsburg, Pa.
- Hagime Ichikawa, A.C., Imperial Printing Bureau, Tokio, Japan.
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## CLASS OF 1892.

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## CLASS OF 1893.

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- Noel W. Smith, C.E., Assistant Supervisor N. C. Ry., York, Pa. Residence: 26 E. Philadelphia Street.
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## CLASS OF 1894.

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- George Washington Scott Baton, B.S. (in Mining), Division Engineer with H. C. Frick Coke Co., Scottdale, Pa.
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- Lawrence Calvin Brink, C.E., 166 West 126th Street, New York City. Employed by N.Y.C. & H.R. R.R. Co.
- Rezeau Blanchard Brown, M.E., Manager, Market St. Works, The Newark Gas Co., Newark, N.J.
- Emott Davis Buel, C.E., Transitman, U.S. Army Engineer Corps, Hudson River Improvement, 51 State Street., Albany, N. Y. Residence: 21 S. Hawk Street.
- James Lindsey Burley, C.E., Civil Engineer, associated with Nathan F. Barrett, Landscape Architect, 50 Wall St., New York City. Residence: Rochelle Park, New Rochelle, N.Y.
- William Colwell Carnell, A.C., Chemist, Union Works, Illinois Steel Co., 3179 Ashland Ave., Chicago, Ill. Residence: 3232 Wabash Avenue.
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- Walter Sewell Dunscomb, C.E., Draughtsman, Building Division, Carnegie Steel Co., Pittsburg, Pa. Residence: Oakmont, Pa.
- Thaddeus Percival Elmore, C.E., Assistant Manager, Havana Bridge Works, Montour Falls, N. Y. Permanent Address: 109 West Chemung Place, Elmira, N.Y.
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& Gamble Co., Ivorydale, Ohio. Residence: Forest  
Ave., Avondale, Cincinnati, O.
- Elwood Aristides Grissinger, E.E., Electrical Engineer  
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- Bayard Guthrie, M.E., Superintendent of the Crucible  
Works of A. M. Guthrie & Co., Limited, 21st and Small-  
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- Anton Yost Hesse, C.E., with Levering and Garrigues,  
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- Philip Henry Trout, jr., E.E., Staunton, Va.
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- William Hopkins, E.E., 1324 18th St., Washington, D.C.
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- Charles Borrows Jacobs, A.C., Head Chemist for the General Electric Co., Schenectady, N.Y. Residence: 8 Union St.
- Elmer Augustus Jacoby, B.A., Instructor in Ulrich's Preparatory School, Bethlehem.
- William Agassiz James, B.S. (in Mining), with William P. Field, Civil Engineer, Prudential Building, Newark, N.J.
- Henry Scudder Jaudon, C.E., Inspector, U. S. Naval Station, Box 333, Port Royal, S.C.
- Albert Beardsley Jessup, B.S., E.M. ('96), Lehigh Valley Coal Co., Wilkes-Barre, Pa.
- Elisha Barton John, C.E., Assistant Engineer's Office, Philadelphia Division, P. R. R., 32d St. and Powelton Ave., Philadelphia, Pa. Residence: 3307 Hamilton St.
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- Dixon Kautz, B.S. (Lat. Sci.), with V. Snyder & Co., Bankers, Moweaqua, Ill.
- Warren Byron Keim, C.E., Structural Draughtsman, with Nathaniel Roberts, Member Am. Soc. C.E., Consulting Engineer, 7 Oak St., Jersey City Heights, N.J.
- Henry Edward Kip, B.S. (in Architecture), Architect, East Aurora, Erie County, N.Y.
- David Henshey Lackey, E.E., Altoona, Pa.
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## CLASS OF 1896.

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- \*John Savage Graff, E.E.
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Charles Howard Morgan, E.E., Maxatawny, Pa.

William Hitz Mussey, E.E., Draughting-Room, Baldwin  
Locomotive Works, Philadelphia, Pa.

John Henry Myers, C.E., Lewistown, Pa.

Franklin Oberly, E.E., Easton, Pa.

Walter Raleigh Okeson, C.E., Bethlehem, Pa.

Louis Atwell Olney, A.C., Providence, R.I.

Horace Lucius Palmer, C.E., Assistant Supervisor of Norfolk  
Division, Norfolk & Western Railway Co., Crewe,  
Va.

Jacob Grafius Petrikin, B.S. (in Architecture), Lock  
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Homer Austin Reid, C.E., Assistant Supervisor Lynchburg Division, Norfolk & Western Railway Co., Lynchburg, Va. Permanent address: 111 N. Chestnut Street, Warren, O.

George Homer Ruggles, C.E., Engineer Corps, Illinois Central R. R., Belleville, Ill. Permanent Address: Cherokee, Ia.

Clement Clarence Rutter, C.E., Lansford, Pa.

John Cornelius Sesser, C.E., St. Joseph, Mich.

\*Arthur Yeager Shepherd, M.E.

Luther D. Showalter, C.E., Pottstown, Pa.

Henry Shriver, jr., M.E., Draughtsman for George's Creek & Cumberland R. R., Cumberland, Md. Address: 77 Washington St.

Edward Stewart Taylor, M.E., Fort Wayne Electric Corporation, Fort Wayne, Ind.

William Bailey Taylor, E.E., 81 Market St., Bethlehem, Pa.

John Augustus Thomson, B.S. (in Metallurgy), Graduate Student, Lehigh University, South Bethlehem, Pa.

Edward Coppée Thurston, B.S. (in Metallurgy), 4 Schren-de Strasse, Freiberg, Saxony, Germany.

Joseph Wharton Thurston, B.A., 311 Cherokee Street, South Bethlehem, Pa.

Curtis Edwards Trafton, E.E., 90 Franklin Street, Fall River, Mass.

Harry Conklin Tripp, M.E., Draughtsman, American Stoker Co., Dayton, O.

John Scofield Wallace, B.S. (in Metallurgy), New Castle, Pa.

Ulysses Grant S. Walters, C.E., Pottstown, Pa.

Harry Dallam Webster, M.E., of the firm of Harry D. Webster & Co., General Agents for Maryland and the District of Columbia of the Racine Fire Engine Co. Address: 210 N. Calvert Street, Baltimore, Md.

\* Deceased.

Frank Thomas Weiler, C.E., Pequea, Pa.

Davis Sanno Williams, B.S. (in Architecture), Fort Snelling, Minn.

David William Wilson, jr., B.S. (in Architecture), Student, Columbia University School of Architecture, New York City. Residence: 381 Greene Ave., Brooklyn.

Job Roberts Wilson, E.E., Engineer's Office, N. Y. Telephone Co., 18 Cortlandt Street, New York City.

Alfred Mahlon Worstall, E.E., General Manager for G. S. W. Brubaker, Contracting Engineer, 39 E. Grant St., Lancaster, Pa.

The number of graduates is 883, degrees having been conferred as follows:

Upon graduates of the School of General Literature: B.A., 47; B.S., 22; Ph.B., 7; M.A., 9.

Upon graduates of the School of Technology: C.E., 323; M.E., 174; B.M., 19; B.S. (in Mining and Metallurgy), 82; E.M., 71; E.E., 98; A.C., 90; B.S. (in Architecture), 11; M.S., 2; Ph. D., 2.

Of these, 9 have taken the degrees of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 33 of B.S. and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of A.C. and M.S.; 2 of A.C., M.S., and Ph. D. 844 graduates are still living.

### ONE-YEAR COURSE IN ELECTRICITY.

Beginning with the year 1884-85, the University offered a special course in Electricity, covering one year's work. Those who completed this course received certificates but no degrees. In 1888, the full four-year course in Physics and Electrical Engineering, leading to the degree of E.E., was established, and the one-year course was withdrawn. The names of those who completed this course are not included in the Roll of Alumni, but are here given:

Elmer Ellsworth Boyer, '85, General Electric Co., Lynn, Mass.

Albert Brodhead, '88, 121 S. Centre Street, Bethlehem, Pa.

Edward Conner, '86, Philadelphia, Pa.

William Fairchild Dean, '88, Thomson-Houston Electric Co., 91 Warren Street, Lynn, Mass.

Horace Musser Engle, '85, Technician, Roanoke, Va.

Herman Frauenthal, '88, M.D., 214 E. 50th St., New York City.

Walter George Fuller, '87, Brattleboro, Vermont.

John Wesley Hackney, '87, Graphic Process Co., Pleasantville, N. J.

James Arthur Heaton, '86, Boston, Mass.

Richard Otto Albert Heinrich, '88.

William Hoopes, '86, Superintendent Edison Electric Co.'s Station, West Chester, Pa.

Joseph Allison Horner, '88.

William Henry Hubbard, '88, General Agent, Helios Electric Co., 1229 Callowhill St., Philadelphia, Pa.

Walter Eugene Hyer, '86.

Daniel Henry Jenkins, '88, Mutual Electric and Accumulator Co., 76 Ashland Place, Brooklyn, N. Y.

Charles Leavitt Jenness, '85, Western Electric Co., Chicago, Ill.

William Sigler Jones, '87, Secretary, The Quaker City Electric Co., 236-238 Carter St., Philadelphia, Pa.  
Residence: 5144 Wayne Avenue, Germantown.

George Herman Koehler, '85, Standard Underground Cable Co., Pittsburg, Pa.

Robert McAllister Lloyd, '86, Electrical Engineer, 27 Pine St., New York City.

Dion M. Martinez, jr., '87, Reading R. R. Co., Philipsburg, Centre Co., Pa.

Charles Jacob Meade, '86, Edison Electric Illuminating Co. of New York, 348 W. 20th Street, New York City.

Charles Jacob Miller, '88.

James Leidy Moore, '88, Thomson-Houston Electric Co., Lynn, Mass.

- George Harrison Neilson, '86, Supervisor, Altoona Division, Pennsylvania R. R., Altoona, Pa.
- Horace Fields Parshall, '87, Edison General Electric Co., Schenectady, N. Y.
- George Herbert Putnam, '85, Instructor in Physics and History, Texas School for the Deaf, Austin, Tex.
- Charles Norris Robinson, '88, Insurance Agent, 420 Walnut St., Philadelphia, Pa.
- Harry Meyer Seitzinger, '88, Manager of Machine and Electrical Department, J. G. Seitzinger Screen and Machine Works, 6 Northampton St., Wilkes-Barre, Pa.
- Arthur Douglas Spear, '87, Brush Electric Co., Cleveland, O.
- Lewis Buckley Stillwell, '85, Assistant Electrician, Westinghouse Electric Co., Pittsburg, Pa.
- Charles Wesley White, '88, Excelsior Electric Co., Brooklyn, N. Y.
- George Henry Wolle, '87, Electrical Accumulator Co., 44 Broadway, New York City.
- Hugh Carlyle Young, '88, Superintendent Wellsboro' Electric Company, Wellsboro', Tioga County, Pa.

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# CONTENTS.

Almanac.

Calendar, 3.

Board of Trustees, 4.

Honorary Trustees, 4.

Honorary Alumni Trustees, 5.

Officers of the Board, 5.

Executive Committee, 5.

Library Committee, 6.

Building Committee, 6.

Comm. on College Administration, 6.

Faculty, 7.

President and Professors, 7.

Lecturers, 8.

Instructors and Assistants, 8.

Gymnasium Service, 11.

Library Service, 11.

Origin and Design of the University, 12.

Tuition, 12.

Public Worship, 13.

Site, 14.

Buildings, 14.

Packer Hall, 14.

The Chemical Laboratory, 14.

The Metallurgical Laboratory, 15.

The Physical Laboratory, 15.

The Sayre Observatory, 17.

The Packer Memorial Church, 17.

The University Library, 17.

The Gymnasium, 17.

Expenses of Students, 18.

Admission of Students, 19.

Date of Examinations, 19.

Character of Examinations, 20.

Requirements for Admission, 20.

Conditional Admission, 26.

Special Students, 26.

Admission to Advanced Studies, 26.

Admission to Graduate Courses, 26.

Preparatory School Certificates, 27.

Program of Studies, 28.

THE SCHOOL OF GENERAL LITERATURE, 28.

The Classical Course, 38.

The Latin-Scientific Course, 43.

The Course in Science and Letters, 46.

THE SCHOOL OF TECHNOLOGY, 50.

The Course in Civil Engineering, 50.

The Course in Mechanical Engineering, 55.

The Courses in Mining Engineering, 61.

Shorter Course in Mining, 71.

The Course in Elect. Eng., 75.

The Course in Chemistry, 80.

The Course in Architecture, 89.

Physical Culture, 92.

Graduating Theses, 93.

Diplomas and Certificates, 93.

Graduate Students, 93.

Graduate Degrees:

Requirements for M.A., 93.

Requirements for M.S., 94.

The University Library, 94.

The Observatory, 96.

The University Museum, 96.

Summer School of Surveying, 97.

Students' Societies, 98.

Founder's Day, 101.

The University Sermon, 101.

Theses presented by candidates for degrees in 1896, 101.

University Day, 108.

Exercises of June 17, 1896, 108.

Award of Wilbur Scholarship, 109.

Award of the Wilbur Prizes, 109.

Degrees Conferred, 110.

The Wilbur Scholarship, 113.

The Alumni Scholarship, 113.

The Henry S. Haines Memorial Scholarship, 113.

The Mercur Memorial Fund Scholarships, 114.

The Wilbur Prizes, 114.

The Alumni Prizes in Oratory, 114.

Examination Papers, 115.

Catalogue of Students, 131.

Graduate Students, 131.

Senior Class, 132.

Junior Class, 134.

Sophomore Class, 136.

Freshman Class, 138.

Special Students, 141.

Summaries of Students:

By States, 142.

By Classes and Courses, 144.

List of Alumni, 145.

Officers of Alumni Association, 207.



The Register is sent to all graduates who furnish their addresses for the purpose, and to all other persons on application to

THE SECRETARY OF THE LEHIGH UNIVERSITY,  
South Bethlehem, Pa.